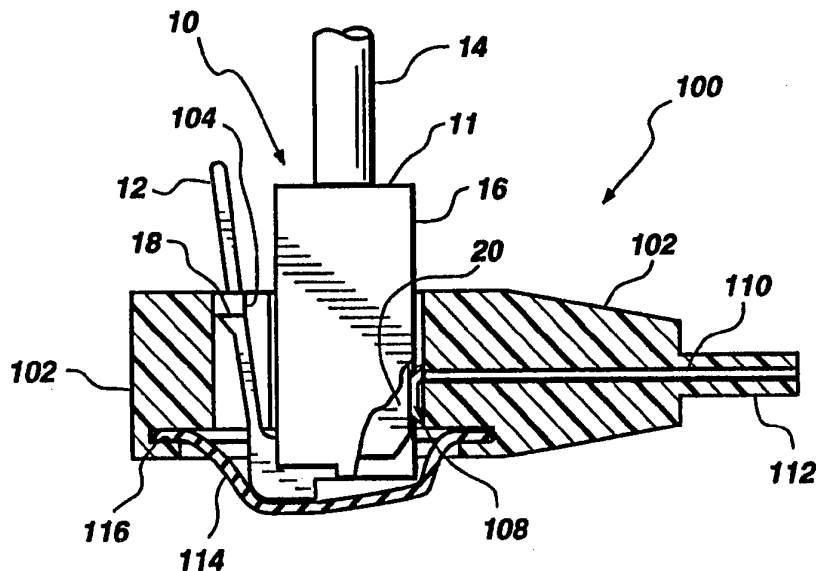




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(54) Title: ADAPTABLE COMMUNICATIONS CONNECTORS



(57) Abstract

An apparatus for conveying signals between a communications card and a signal utilization device or network. In one form, structures are provided for receiving an RJ series plug (10) and for making electrical connection with at least first and second contacts (20) on the plug (10) and conveying any signals on the contacts (20) to a communications device such as a telephone, facsimile machine, modem, or a local area network adapter. A body (102) includes one or more recesses (134) which receive the plug (10). An expandable and stretchable membrane (114) isolates the contacts in the plug (10) from electrical contact with an object in a surrounding environment such that passage of current from one or more of the electrical contacts to an object present in the surrounding environment is prevented. Also provided is a replaceable direct access arrangement (148) which is replaceably held within the communications device.

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ADAPTABLE COMMUNICATIONS CONNECTORS

BACKGROUND

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1. The Field of the Invention.

This invention relates to electronic communication devices. More particularly, the present invention relates to connectors used to attach a communications line to a computer.

15

2. The Background Art.

20

Telecommunications services have become an integral part of modern society. The number of telephones in the United States alone exceeds 150 million. Moreover, communications within an organization between people and machines further increases the size of the communications network. The vast majority of the communications devices now in use require a wired connection to a communications line. Such communications devices include, for example, telephones, facsimile machines, modems, and local area network (LAN) adapters. Wireless communications, however, are becoming more commonplace in many instances.

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In order to conveniently attach a communications line to a communications device, standard connectors have been promulgated. The most popular of these connectors is known in the art as the RJ series of connectors. Of the RJ series of connectors, the RJ-11, RJ-12, and RJ-45 connectors are widely used. The RJ-11 connector comprises a six contact plug and a corresponding jack which is standardized in the industrialized world. The conventional six contact RJ-11 connector has the desirable attributes of having both low cost and high reliability.

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The RJ-11 connector is commonly used to attach a communications device such as a telephone, facsimile machine, or a modem (all of which may be integrated into a single device) to a communications line. Such devices are becoming smaller, so small that one or more

dimensions of the customary RJ-11 jack, also referred to as a receptacle, is larger than a corresponding dimension of communications device. For example, communication devices which comply with the Personal Computer Memory Card International Association (PCMCIA), also referred to as PC Card, standards have dimensions of about 2.1 inches by about 3.4 inches with a thickness of only 3.5mm, 5mm, or 8mm. Such small communications devices cannot incorporate customary RJ series receptacles but still require compatibility with RJ series plugs in order to attach to a communications line.

U.S. Patent No. 5,183,404 to Aldous provides several schemes for providing a miniature RJ-11 compatible receptacle. Disadvantageously, many of the schemes set forth in Aldous leave the electrical contacts exposed to the surrounding environment. Thus, a user may come in contact with the electrical contacts of the plug, which in the U.S. may carry more than 80 volts. Further, since the contacts of the RJ-11 plug are exposed, the contacts may be inadvertently shorted together. Thus, the scheme included in the Aldous reference presents a danger of electrical shock and electrical short circuit. Moreover, some of the receptacle schemes disclosed in the Aldous reference are particularly prone to breakage and damage because of inherently weak structures.

Thus, it would be an advance in the art to provide a miniaturized communications line connector which overcomes these drawbacks.

BRIEF SUMMARY AND OBJECTS OF THE INVENTION

In view of the above described state of the art, the present invention seeks to realize the following objects and advantages.

It is a primary object of the present invention to provide a communications line receptacle for use with a

miniaturized communications device wherein the electrical contacts are shielded or isolated from the surrounding environment.

5 It is also an object of the present invention to provide a miniaturized communications line connector which is resistant to breakage and which can be stored out of the way when not being used.

10 It is a further object of the present invention to provide a communications line receptacle which is readily replaceable if broken.

It is another object of the present invention to provide a communications card which can be readily adapted to meet various communications standards.

15 It is a further object of the present invention to provide a communications card which can provide wireless communications.

20 These and other objects and advantages of the invention will become more fully apparent from the description and claims which follow, or may be learned by the practice of the invention.

25 The present invention provides an apparatus for receiving an RJ series plug and making electrical connection with at least two conductors on the plug and conveying any signals on the conductors to a communications device such as a telephone, facsimile machine, modem, local area network adapter, or some other device.

30 The apparatus includes a body, also referred to as a body means. A recess, or recess means, is provided on the body. In some embodiments the recess means preferably includes an open first end and a closed second end. In other embodiments, the recess means preferably includes open first and second ends. The recess means preferably has dimensions such that the
35 plug is closely received therein. A means is also provided for releasably engaging the plug such that the plug is releasably held in the recess.

At least first and second electrical conductors are provided in the recess. Each of the electrical conductors are positioned such that they have electrical continuity with the electrical contacts in the plug when the plug is received into the recess. A means for conveying any electrical signal present on the electrical contacts to the communications device is also provided.

A replaceable direct access arrangement unit allows the communications card to be interfaced with telephone systems, or other communications systems, which may each require adherence to a different standard. When necessary, a user merely replaces an existing direct access arrangement unit with another direct access arrangement unit which is compatible with the wired telephone system or the wireless communications system that is available to the user.

Also preferably included with the recess means is an expandable means for isolating the contacts in the plug from electrical continuity with an object in a surrounding environment such that passage of current from one or more of the electrical contacts to an object present in the surrounding environment is prevented. The expandable means is located at the second end of the recess and is preferably a stretchable membrane. The expandable means expands to accommodate a plug received in the recess and tends to return, and can be returned by a user, to a position within the thickness of the body when not being used so the apparatus assumes a compact configuration.

Embodiments of the present invention include receptacle modules which receive an RJ series plug. One preferred embodiment of the present invention includes a means for holding the body which receives the RJ series plug. The means for holding the receptacle body or the receptacle module can be easily installed in and removed from the communications device by the user. The

present invention allows the body to be retracted into and extended from the communications device while still allowing easy removal and replacement of the body making up the receptacle module. Another preferred embodiment of the present invention includes means for pivotally rotating the body into and out of the communications device such that the body is substantially entirely within the communications device when not being used and the body is rotated to a position where the recess which receives the plug is accessible to the user when desired.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to better appreciate how the above-recited and other advantages and objects of the invention are obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

Figure 1 is a partial perspective view of a lap top computer with a communications card partially inserted therein and a first embodiment of the present invention ready to be coupled to the communications card.

Figure 2 is a cross sectional view of the first embodiment of the present invention represented in Figure 1.

Figure 3 is a reverse perspective view of the first embodiment of the present invention represented in Figure 1.

Figure 4 is a perspective view of a second embodiment of the present invention with a receptacle module illustrated in a retracted position.

Figure 5 is a perspective view of the second embodiment of the present invention represented in Figure 4 illustrated in an extended position.

5 Figure 6 is a perspective view of a third embodiment of the present invention with a removable receptacle module illustrated in a retracted position.

10 Figure 7 is a perspective view of the third embodiment of the present invention represented in Figure 6 with the removable receptacle module illustrated in an extended position.

Figure 8 is a top plan view of the removable receptacle module represented in Figure 7.

Figure 9 is a top plan view of the removable receptacle module represented in Figure 6.

15 Figure 10 is a perspective view of a fourth embodiment of the present invention with the receptacle module illustrated in a retracted position.

20 Figure 11 is a perspective view of the fourth embodiment of the present invention represented in Figure 10 with the receptacle module illustrated in an extended position.

Figure 12 is a perspective view of a fifth embodiment of the present invention.

25 Figure 13 is a side elevational view of the fifth embodiment of the present invention represented in Figure 12.

30 Figure 14 is a perspective view of a sixth embodiment of the present invention having a replaceable direct access arrangement unit ready to be inserted into the communications card.

Figure 14A is an end view taken along line 14A-14A of Figure 14.

35 Figure 14B is a perspective view of the embodiment illustrated in Figure 14 showing the components retracted into the communications card.

Figures 14C-E are block diagrams illustrating the preferred functions carried out by the replaceable direct access arrangement unit.

5 Figure 14F is a top view of a communications card having another replaceable direct access arrangement unit installed therein.

10 Figures 15A and 15B are top views showing the electrical interconnection between the receptacle module and the replaceable direct access arrangement (not shown in these figures) and the accompanying mechanism which retracts and extends the receptacle module into and out of the replaceable direct access arrangement.

15 Figure 15C is a detailed side view of the electrical interconnection circuit between the receptacle module and the frame.

Figure 15D is a detailed perspective view of the electrical interconnection circuit between the receptacle module and the frame.

20 Figures 16A, 16B and 16C are side views, and Figure 16D is a top view, of a mechanism which functions to retract and extend the receptacle module into and out of the replaceable direct access arrangement.

25 Figures 17A and 17B are top views showing the electrical interconnection between the receptacle module and the replaceable direct access arrangement and the accompanying mechanism which retracts and extends the receptacle module into and out of the replaceable direct access arrangement.

30 Figure 17C is a detailed perspective view of the electrical interconnection circuit between the receptacle module and the frame represented in Figures 17A-B.

35 Figures 18A and 18B are top and side views, respectively, of a mechanism which functions to retract and extend the receptacle module into and out of the replaceable direct access arrangement.

Figures 19A-C are perspective views of three different antenna configurations which may be included in embodiments of the present invention.

5 Figure 20 is a perspective view of an embodiment of the present invention which is adapted for use with a portable cellular telephone.

10 Figure 21 is a perspective view of a communications card in accordance with the present invention having an RJ-xx series receptacle placed directly in the end thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made to the drawings wherein like structures will be provided with like reference designations. As is evident to those skilled in the art, advances in technology is allowing many different electrical devices to be made smaller than was contemplated just a few years ago. Represented in Figure 1 is a partial perspective view of a lap top computer 8. In order to meet the demand for devices utilized with such lap top computers without adding any significant weight or bulk, devices such as a modem card 118 (shown partially withdrawn from the lap top computer 8) which complies with the PCMCIA (also known as PC Card) standards have been produced. Significantly, while most lap top computers are generally note book size (about 8.5 inches by about 11 inches), the need for further miniaturization of devices such as the modem card 118 will increase as computing devices of all kinds continue to shrink.

30 The modem card 118 can also represent numerous other communication devices, for example, a local area network adaptor, voice mail device, or a facsimile device. Indeed, with the continuing trend of miniaturizing such devices, all of these devices may be combined into one card the size of the modem card 118 represented in Figure 1. All of these devices are

examples of those intended to come within the scope of the meaning of the term "communication devices" as used herein. Even further, other devices which require communication with one or more additional devices which are now available or which may become available in the future are intended to also come within the meaning of the term communication devices as used herein.

As used herein, the term "data utilization device" is intended to include all digital computing devices which are adaptable to receive data or instructions via a communications medium. Perhaps the most common current example of such a device is the personal computer.

A plug, which is compatible with the RJ series industry standard, is indicated generally at 10 in Figures 1 and 3. The RJ plug 10 includes a block 11 which has a first face 16 into which a plurality of electrical contacts 20 are recessed. The electrical contacts 20 are connected to wires (not represented) contained within a cable 14 which lead to the communications network, to another communications device, or other device. A biased clip 12, which is integrally molded as part of the block 11, is used to hold the plug in a corresponding receptacle.

Detailed information regarding the RJ series of connectors can be found in the publication found at Title 47 (Telecommunications), Code of Federal Regulations, Chapter I (Federal Communications Commission), Subchapter B (Common Carrier Services), Part 68 (Connection of Terminal Equipment to the Telephone Network), Subpart F (Connectors), Section 68.500 (1992) which is now incorporated herein by reference in its entirety.

Figures 1-3 represent a first preferred arrangement of the present invention embodied in a receptacle module generally represented at 100. The receptacle module 100 includes a male coupling 112 which provides both

physical and electrical connections to a corresponding female coupling 120 provided in the modem card 120.

5 The receptacle module 100 includes a body 102 which can preferably be fabricated from a plastic material using techniques known in the art. Two recesses, both of which are generally indicated at 106 in Figure 3, are formed in the body 102. The inclusion of two recesses 106 desirably allows accommodation of two communication lines by the receptacle module 100.

10 A cross sectional view of one of the recesses 106 is provided in Figure 2. Figure 2 also shows the plug 10 inserted into the recess 106. The recess 106 has a first open end and a second closed end. When an RJ series plug is inserted into the recess 106, a plurality of conductors 108 communicates with one of its
15 respective contacts 20. The conductors 108 are preferably spring-like so that they are in firm electrical continuity with the contacts 20. In some applications only two conductors 108 are provided while
20 more than two conductors 108 are provided in other applications. Each of the conductors 108 is joined to a respective hollow pin, one of which is shown in cross section at 110, which mates with corresponding pins provided in the female coupling (120 in Figure 1).

25 Still referring to Figure 2, as the plug 10 is received into the recess, a ledge 104 provided on the biased clip 12 engages a ridge 18 formed on the body 102 and protrudes into the recess 106. The biased clip 12 and the ledge 104 cooperate to hold the plug 10 in the
30 recess 106. When removal of the plug 10 is desired, the biased clip 12 is compressed and the plug 10 is removed from the recess 106.

35 Enclosing one end of the recess is an expandable member 114. In the embodiment of the invention represented in Figure 2, the expandable member is an elastic and stretchable membrane. The expandable member 114 is preferably a rubber-like material which is an

electrical insulator. The expandable member 114 is anchored in a groove 116 provided in the body 102 around the recess 106.

5 As clearly shown in the cross section of Figure 2, when the plug 10 is fully inserted into the recess 106 the expandable member 114 is moved to expand the depth of the recess 106. The expandable member 114 isolates the contacts 20 from exposure to the surrounding environment. If the expandable member 114 were not
10 included, as in the previously available schemes, the contacts 20 would be exposed to the surrounding environment and the possibility that the contacts 20 will be shorted together is present. It is also possible that the contacts 20 could be shorted to an
15 electrical ground, pass a current to a user who touches the contacts 20, or some other event might occur which would damage the communications devices attached to the cable 14. As known in the art, voltages of more than 70 volts regularly are present on the contacts 20 when
20 connected to the common carrier telephone network in the United States.

The illustrated expandable member 114 is preferably fabricated from a rubber-like material which is flexible enough to allow the end of the plug 10 to expand the
25 flexible member 114 without undue force being exerted on the plug 10. The material from which the expandable member 114 is fabricated should be strong enough to allow long time use without any failure, e.g., tearing. Those skilled in the art will appreciate that the
30 perimeter of the expandable member 114 should be securely anchored in the groove 116.

It is to be understood that structures other than the expandable member 114 can function as the expandable means for isolating the contacts 20 from electrical
35 continuity with any object in the surrounding environment. For example, a combination of rigid panels joined together to allow expansion can function as the

expandable means. Further, a combination of rigid elements and elastic elements, or one or more rigid elements which fold within the thickness of the body 102, can be devised using the information contained herein. It is preferred that the thickness of the body 102 be not greater than the thickness of the modem card 118. Thus, the expandable member 114 should tend to automatically return to within the plane of the body 102 once the plug 10 is removed and/or allow the user to collapse the expandable member 114.

Referring to Figure 3, it is preferred that the recesses 106 have particular dimensions. It is preferred that the two unbroken side walls of the recess each have a length in the range from about .265 inches to about .285 inches and the single remaining straight wall, which is perpendicular to the two side walls, have a dimension in the range from about .45 inches to about .475 inches for compatibility with RJ-45 plugs. It is also preferred that the two unbroken side walls of the recess have a length in the range from about .265 inches to about .285 inches and the single remaining straight wall, which is perpendicular to the two side walls, have a dimension in the range from about .375 inches to about .4 inches for compatibility with RJ-11 and RJ-12 plugs.

Figure 4 is a perspective view of a second embodiment of the present invention with a receptacle module, generally represented at 131. The receptacle module 131 is illustrated in Figure 4 as being retracted into a communications card 130. The communications card 130 can house any of the communications devices indicated earlier.

The receptacle module 131 includes a body 132 and a finger pull 148 formed thereon. The receptacle module 131 is conveniently kept in its retracted position illustrated in Figure 4 until the communications card 130 needs to be connected to a communications line (not shown in Figure 4). When needed, the user grasps the

finger pull 148 and pulls the receptacle module 131 to its extended position represented in Figure 5.

Figure 5 illustrates the receptacle modules in its extended position. The receptacle module 131 includes
5 a pair of ridges (one shown in phantom image at 140 in Figures 4 and 5) which extend from the sides of the receptacle module 131 and which slide along a pair of grooves, shown best in phantom image in Figure 5 at 138.

The receptacle module 131 includes two recesses,
10 each generally indicated at 134, with each recess including a plurality of conductors 146. Each recess 134 also preferably includes an expandable member 144 which can be identical, similar, or equivalent to the expandable member 114 discussed in connection with
15 Figures 1-3.

Figure 6 is a perspective view of a third embodiment of the present invention including a removable receptacle module generally represented at
20 151. The removable receptacle module 151 is shown in place in a communications card 150 as has been explained earlier. The removable receptacle module includes a body 166 which is illustrated in Figure 6 in a retracted position. It will be appreciated that the retracted position illustrated in Figure 6 can be used or the body
25 166 can be fully withdrawn into the communications card 150 housing. In order to use the apparatus, a user preferably grasps finger grips 166 and pulls the body 166 out to an extended position as represented in Figure 7.

30 The removable receptacle module 151 is advantageously easily removable from the communications card 150. In order to remove the entire removable receptacle module 151 from the communications card 150, a pair of wings 158 are squeezed inwardly so a ledge
35 (158 in Figure 8) provided on each wing 158 disengages from an edge 162 of the communications card 150 housing. The entire removable receptacle module 151 can then be

removed from the communications card 150. It will be appreciated that other structures can carry out the function of the wings 158, as will be explained later in this disclosure.

5 It is common for a receptacle module to be broken or damaged during use. If a receptacle module, or other structure providing connection to a communications line is permanently affixed to the communications card or its equivalent, then the only practical recourse is
10 replacement of the entire communications card, even though only the receptacle module has been damaged. The embodiment of the present invention represented in Figures 6-9 provides that the receptacle module can be easily replaced in case of damage.

15 Moreover, the removable receptacle module 151 can be replaced with another removable receptacle module which is adapted to receive another size or style of plug (not represented in Figures 6-9). For example, the RJ-11, RJ-12, and RJ-45 connectors have all been
20 generally adopted for specialized applications. Thus, a removable receptacle module adapted for use with RJ-11 plugs can be easily replaced with a removable receptacle module adapted for use with RJ-45 plugs and so forth.

25 Figures 8 and 9 provide detailed views of the removable receptacle module 151 with the body 166 in an extended and retracted position, respectively. Provided in the body 166 are a pair of recesses, generally indicated at 154, and a plurality of conductors 156. Each recess 154 preferably includes an expandable
30 member, generally indicated at 154, as has been previously explained.

35 As represented in Figures 8 and 9, the removable receptacle module 151 includes a shell 168 from which the wings 156 extend and in which the body 166 slides. It will be appreciated that many different structures can be devised by those skilled in the art to carry out the functions of the shell using the teachings contained

herein. Attached to the body 166 are three guides 172 which slide within three respective grooves 170. The guides 172 and the grooves 172 are configured so that the body 168 is held captive in, i.e., cannot be completely removed from, the shell 168. Also represented in Figures 8 and 9 are a plurality of electrical conductors indicated at brackets 174 which mate with suitable structures within the communications card 150 housing to allow transfer of signals between the communications line (not illustrated in Figures 8 and 9) and the communications card (150 in Figures 6 and 7).

It will be appreciated that since the housing 168 of the receptacle module 151 is retained within the communications card 151, and that the communications card 150 is held within a lap top computer or a cabinet of some kind, the shell 168 is protected from breakage and damage so it can be removed without undue difficulty even if damage does occur to other components of the removable receptacle module 151.

Figure 10 provides a perspective view of a fourth embodiment of the present invention. The embodiment illustrated in Figure 10 includes a receptacle module, generally indicated at 181, illustrated in a retracted position. The receptacle module 181 includes a body 184 which is preferably semicircular in shape and rests, when in its retracted position, within a cavity in a communications card 180, the cavity being generally indicated at 182 in Figure 11. The cavity 182 is preferably semicircular in shape but can be any shape which provides sufficient room to accommodate the body 184 in its retracted position.

The body 184 is attached to the communications card 180 housing by way of a pivot 186. The pivot 186 allows the body 184 to be rotated by pulling on a finger grip 188 to an extended position as illustrated in Figure 11. In its extended position, the receptacle module 181

allows access to a recess 190 which is preferably configured as explained earlier and is ready to receive a plug, such as plug 10 in Figure 1. Electrical connections between the conductors (not illustrated) disposed in the recess 190 and the circuitry contained in the communications card 190 are provided as can be designed by those skilled in the art. Those skilled in the art can also arrive at numerous structures which are equivalent to those illustrated in Figures 10 and 11 using the teachings contained herein.

Figure 12 provides a perspective view of a fifth embodiment of the present invention which includes a receptacle module, generally indicated at 200, with male couplings 204 similar to those represented in Figures 1-3 at 112 and which are received by a communications card such as those described earlier. A body 202 is provided with a recess into which the plug 10 is inserted. As illustrated best in the cross sectional view of Figure 13, a plurality of conductors 206 are provided which communicate with respective contacts 20 on the plug 10.

With the plug 10 in position on the body 202, a lever 208 holds the plug 10 in place. The lever 208 is biased toward the body 202 by a spring 210. A ledge 212 provided on the lever 208 engages the ridge (18 in Figures 2 and 3) provided on the clip 12 to further hold the plug in place. An aperture is provided on the lever 208 to accommodate a hump 22 which is provided on plugs which comply with the RJ series standards. It will be appreciated that the biased lever provides a much more secure and convenient to use apparatus than any of those available in the art which are suitable for use with RJ series plugs and which is suitable for use with miniaturized devices such as the previously described communications cards.

Reference will next be made to Figure 14. Figure 14 provides a perspective view of a preferred sixth embodiment of the present invention. The embodiment of

Figure 14 provides a communications card 250 which includes a replaceable direct access arrangement 258 which is shown ready to be inserted into the communications card 250. As is known in the industry, the communications card 250 makes electrical connection to a computing device via connector sockets, which are represented at 252 in Figure 14.

The inclusion of a replaceable direct access arrangement, also referred to as a data access arrangement (abbreviated "DAA"), provides important advantages not previously available in the industry. In the past, DAAs provided a few functions such as: matching the impedances between the telephone line and the modem; receiving data from the telephone line; transmitting data onto the telephone line; providing a pulse dial; and detecting an incoming ring signal. Significantly, different countries and regions of the world require that the DAA carry out different functions.

Presently, it has become a practice in the industry to supply a DAA with a modem in accordance with whatever country the user intends to make the connection to a telephone line, i.e., "U.S." modems are sold in the U.S. and "German" modems are sold in Germany. Since desktop personal computers are very seldom moved from country to country, it has been satisfactory in the past to purchase a modem which can be used in only one country; if the user moved, a new modem was purchased if necessary.

Significantly, the widespread popularity of portable personal computers, and the use of PCMCIA cards in desktop computers, has meant that the computer or the computer peripheral is not bound to any particular location but can travel to any location in the world. Unfortunately, the industry has not recognized, and has not begun to effectively solve, the problems faced by a portable computer user traveling from country to

country. Available telephone communication devices are ill suited for use in one or more countries which a user might visit. Even if the desirability of providing a telephone communication device and DAA which is suitable for use in multiple countries was recognized in the industry, the requirements of some countries mandate the use of components which seem too large to allow their incorporation into a communications card which is used with a portable computer.

The present invention solves these problems found in the industry by including a replaceable DAA 258 which is received into a cavity which is generally indicated at 254 in Figure 14. The replaceable DAA 258 not only can carry out the customary functions already known in the art, but in accordance with the present invention the replaceable DAA 258 can also carry out other desirable functions as described herein.

The replaceable DAA 258 preferably makes electrical connection with the communications card 250 via twenty connector pins 256 provided in the back of the cavity 254 and corresponding connector sockets 260 provided on the rear of the DAA 258. As necessary, a user can install an appropriate replaceable DAA 258 to perform the functions necessary to obtain direct connection to a country's telephone system or to perform some other function.

It will be appreciated, and as will be explained shortly, the replaceable DAA 258 can house components different than those necessary to connect to a telephone line such as providing the components necessary to interface with a computer network or provide wireless communication service such as cellular telephone service or carry out some other function.

Represented in Figure 14 are grooves 255 into which are received respective ridges 262 provided on the sides

of the replaceable DAA 258. The grooves 255 are more clearly represented in the end view of Figure 14A. The grooves 255 and the ridges 262 function to guide the replaceable DAA 258 into and out of the cavity 254. The replaceable DAA 258 is preferably held in the cavity 254 by a pair of flexible ledges 264 which engage corresponding notches 257 provided on the inner surface of the cavity 254. Figure 14B illustrates the communications card 250 when the replaceable DAA 258 is fully inserted into the cavity 254.

To remove the replaceable DAA 258 from the remainder of the communications card 250, a pair of tabs 266 are squeezed, resulting in the ledges 264 being released from the notches 257, and allowing the replaceable DAA 258 to be extracted from the cavity 254. It will be appreciated that many different arrangements can be arrived at by those skilled in the art to allow the components of the replaceable DAA 258 to be connected to, and removed from, the remainder of the communications card 250.

The replaceable DAA 258 illustrated in Figure 14 is provided with a receptacle module 270 which is provided with a pair of RJ-xx series receptacles represented at 278A&B which are adapted to connect to a communications line having a RJ-xx series plug such as those represented in Figure 1-3. It will be appreciated that the RJ-xx series receptacles 278A&B can be provided with the expandable member 114 shown in Figure 2 if desired. It is within the scope of the present invention to provide the receptacle module 270 with structures to allow its removal as shown in Figure 1 or to include structures to allow extension out of, as shown by the phantom image of Figure 14, the replaceable DAA 258 and retraction into the replaceable DAA 258 in the direction of arrow 272 as represented in Figure 14B.

Figures 14C-E are high level block diagrams illustrating some of the preferred functions carried out

by the replaceable DAA 258. As suggested above, a number of different replaceable DAA 258 units can be provided, each being adapted to carry out a particular function and the user changing the replaceable DAA 258 as necessary. Provided below in Tables A-C are descriptions of the preferred functions carried out by the blocks represented in Figures 14C-E, respectively.

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274A	Modem connection
274B	Hybrid circuit
274C	AC impedance network
274D	Signal transducer
274E	Line connector
274F	Transient protection
274G	Loop relay
274H	DC holding current
274I	Ring detect circuit

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Table B - Figure 14D Norway DAA	
275A	Modem connection
275B	Hybrid circuit
275C	AC impedance network
275D	Signal transducer
275E	Loop relays
275F	Transient protection
275G	Line connector
275H	Pulse dial
275I	DC holding current
275J	Ring detect

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Table C - Figure 14E German DAA	
276A	Modem connection
276B	Hybrid circuit
276C	AC impudence network
276D	Signal transducer
276E	Loop relays
276F	Transient protection
276G	Line connector
276H	Billing tone filter
276I	Pulse dial
276J	DC holding current
276K	Ring detect

Figure 14F shows a receptacle module 270A which includes only a single RJ-xx series receptacle. Some country's regulations require that only a single telephone line be connected to a telecommunications device. The RJ-xx series receptacle illustrated in Figure 14F is preferably an eight conductor RJ-45 receptacle. The DAA to which the receptacle module 270A is connected preferably provides the interfacing functions needed to directly attach to the telephone system of the particular country or countries.

Reference will next be made to Figures 15A-D which are detailed views of the receptacle module 270 and the structures which allow the receptacle module 270 to

extend out of or retract into the replaceable DAA 258 (shown in Figure 14). It will be appreciated that the structures which allow extension and retraction of the receptacle module 270 can be incorporated into the replaceable DAA 258, directly into a communications card 250, or into any other device which would benefit from the compact communications connector described herein.

Prior to the present invention, if the structures providing RJ-xx series connectors were affixed to the PCMCIA communications card, the connectors would be broken off or damaged and the user would be required to discard the entire communications card and would be stranded with an inoperative communications card. The devices described in U.S. Patent No. 5,183,404 to Aldous are particularly afflicted by this problem. Prior to the advent of the instant invention, the industry had not recognized the described incidents as a significant problem and the industry has not been able to arrive at the solution described herein.

The present invention allows the structures which provide the communications receptacles to be readily replaced by the user. The user may need to replace the structures which provide the communications receptacles due to damage or in order to interface with different communications lines or devices. The present invention provides these advantages which have not otherwise been available in the industry. Thus, the user can replace damaged receptacle structures, or replace the structure if other functions are necessary, quickly and without any difficulty.

Represented in Figures 15A and 15B is a receptacle module 270 which includes two RJ-xx series receptacles, generally represented at 278A&B. Figure 15A shows the receptacle module 270 in its retracted position. Figure 15B shows the receptacle module 270 in its extended position. Each of the RJ-xx series receptacles 278A&B is provided with four conductors represented at bracket

284. It will be understood that the representation of the RJ-xx series receptacles described herein is exemplary of one presently preferred application with inclusion of other types of connectors and devices also being within the scope of the present invention.

5

A frame 280 is shown in Figures 15A&B. The frame 280 is, for example, received into a cavity (not represented in Figures 15A&B) provided in the replaceable DAA 258 and is held in place by locking ridges 290 which engage notches 273 (Figure 14). An electrical connector represented at 282 in Figure 15A-B provides electrical connection and provides further physical stability and can be selected by those skilled in the art using the information provided herein. The frame 280 is removed from the replaceable DAA 258 by the user squeezing together tabs 292 and the frame 280 being pulled from the replaceable DAA 258. It will be appreciated that the structures represented in Figures 15A&B can be incorporated into many different devices which are now available in the industry or which may become available in the future.

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As represented in Figures 15A&B, the receptacle module 270 is biased in its extended position by springs 286. The springs 286 are held in place by posts 286A and 286B. A flexible interconnecting circuit 288 provides electrical connection between the connector 282 and the conductors 284. Further information regarding the interconnecting circuit 288 will be provided in connection with Figures 15C&D. As will be appreciated by those skilled in the art, the structures described herein provide the advantage of being more compact than previously possible following conventional teachings in the art.

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Figures 15C&D show a flexible interconnecting circuit 288 which provides a plurality of conductors indicated at 288A. The flexible interconnecting circuit 288, rather than utilizing pin and socket terminal

connections, relies on surface mount connections thus making the structures more compact. The electrical signals received at the connector 282 (Figures 15A&B) are conveyed to conductors (not illustrated) formed on the surface of a bar 289 and a holding clip 291 presses the conductors 288A onto the appropriate conductors formed on the surface of the bar 289. The flexible interconnecting circuit 288 bends as necessary to accommodate the extension and retraction of the receptacle module 270.

To make a surface electrical connection with the conductors of the RJ-xx series receptacles, the conductors 271 being held in place by a member 271, the flexible interconnecting circuit 288 is folded so that the conductors 288A are pressed against a corresponding conductor represented at 284. The flexible interconnecting circuit 288 is held in place on the member 271 by a clip 277. The receptacle module 270 can provide electrical interconnection between the conductors 284 of the RJ-xx series receptacles 278A&B. Using the described structure, a reliable and compact arrangement is provided to make electrical connection with the RJ-xx series receptacles.

Referring again to Figures 15A&B, a pair of flexible arms 279 are each provided with a protruding knob 281 which is received into a groove formed in the inner surface of the frame which allows the receptacle module 270 to slide within the frame 280 and hold the receptacle module 270 in either its extended or retracted position. Projecting from the side of the receptacle module 270 are wings 282 which provide further positional stability. The leading edge 282A of the wings 282 abuts a stop 283 on the frame to limit the extension motion of the receptacle module 270. The operation of the flexible arms 279 in the retraction and extension movement will be explained in further detail by reference to Figures 16A-D.

Figure 16A is a side view of the inner surface of the frame 280 showing a groove 306 formed therein and the receptacle module 270 in its retracted position. As can be seen in Figure 16A, the knob 281 is held in a trough 306A. The shape of the knob 281 and the shape of the trough 306A, together with the biasing action of the springs (286 in Figures 15A&B), keep the knob 281 in the trough 306A. When extension of the receptacle module (270 in Figures 15A&B) is desired, the user pushes in on the receptacle module 270 so that the sloping rear side of the knob 281 causes the free end of the flexible arm 279 to bend upward allowing the knob 281 to escape the trough 306A and move forward in the groove 306 to the extended position represented in Figure 16B.

Figure 16C provides a side view of the flexible arm 279 showing its vertical movement as represented by arrow 308. Figure 16D provides a top view of a portion of the receptacle module 270 further showing the shape of the knob 281 and the horizontal movement of the flexible arm 279. It will be appreciated that the described structures provide a simple and reliable arrangement for extending and retracting the receptacle module 270 and which advantageously is more compact than previously available structures. By making the retraction and extension structures more compact, more room is provided for other components.

Reference will next be made to Figures 17A-C which illustrate in detail additional structures which allow the receptacle module 270 to extend out of or retract into the replaceable DAA 258 (shown in Figure 14) and the electrical interconnection between the connector 287 and the conductors 284 in the RJ-xx series receptacles. Many of the structures represented in Figures 17A&B are the same as the correspondingly numbered structures represented in Figures 15A&B. Thus, only the differences between the represented structures will be described.

5 Represented in Figures 17A&B is one of at least two exposed conductors represented at 294A which is attached to the inner surface of frame 280. Figure 17C shows two sliding electrical contacts 296A and 296B. The sliding electrical contacts 296A&B are preferably of the spring type to ensure that each of the sliding electrical contacts 296A&B makes solid electrical contact to each of the respective conductors, one of which is represented at 294A in the top views of Figures 17A&B. 10 An electrical connection is made from the sliding electrical contacts 296A&B, through the receptacle module 270, and to the appropriate conductor 284. It will be understood that many variations on the electrical interconnection structures can be carried out within the scope of the present invention using the information set forth herein. 15

20 Figures 18A&B will be referred to next to describe the structures which allow the receptacle module 270 to extend and retract. Figure 18A is a cross sectional top view of the receptacle module 270 showing a groove formed therein.

Still referring to Figure 18A, provided on the inner surface of the stop 283 is a pin 301 which is held in a recess 304 and biased outwardly from the recess 304 by a spring 302. In Figure 18A, the solid image of the stop 283 and the pin 301 shows their position in the groove 300 when the receptacle module 270 is in its extended position. The biasing force of the spring 286, partially represented in Figures 18A&B, holds the receptacle module 270 in its extended position. 30

Reference will now be made to both Figures 18A and 18B to explain the movement of the receptacle module 270 from its extended position to its retracted position. When the receptacle module 270 is to be moved to its retracted position, the user (not represented in the figures), pushes the receptacle module 270 toward the frame 280. The pin 301 travels in the groove 300 up the 35

ramp 300A and into the well 300B where the pin 301 is held. The retracted position of the receptacle module 270 is represented by the phantom image in Figure 18A. To move the receptacle module 270 from its retracted position to its extended position, the user again pushes the receptacle module 270 inward toward the frame 280 which causes the pin 301 to move out of the well 300B up a ramp indicated by arrow 300C. The user then releases the receptacle module 270 which allows the receptacle module 270 to extend and the pin 301 to travel down a ramp indicated by arrow 300D where the pin 301 again enters groove 300 and the receptacle module 270 completes its extension.

Reference will next be made to Figures 19A-C. In order to accommodate wireless communication between the communications card and a wireless communication system, an antenna is provided on the communications cards represented in Figures 19A-C. The embodiments of the present invention illustrated in Figures 19A-C are particularly adapted for accommodating cellular telephone signals but those skilled in the art can readily adapt the embodiments to accommodate other communication systems, including those utilizing radio frequency techniques as well as other mediums.

Figure 19A illustrates an antenna 312 which pivots into and out of the end of the communications card 250 in the directions of arrow 312A. When use of the antenna is desired, the user depresses a release button 315 which allows the antenna to pivot out of the end of the communications card.

Figure 19B illustrates an antenna 318 which is pivotally mounted on a retractable block 314. When use of the antenna is desired, the user depresses a release button 315 which allows the antenna 318 to pivot in the directions of arrow 318A. The retractable block 314 can be stored within the communications card and extended and retracted in the directions of arrow 314A and

released from its retracted position by depressing button 316.

5 Figure 19C illustrates an antenna 322 which is pivotally mounted on a retractable block 320. The retractable block 320 is extended by depression of button 316. When the retractable block 320 is extended, the antenna 322 is pivoted up or down in the direction of arrow 322A. Also provided on the retractable block 320 is a receptacle 324 allowing a communications line
10 to also be attached thereto.

Each of the arrangements represented in Figures 19A-C can be best adapted for use with particular types of antenna which may assume shapes and sizes very different than the illustrated antennas. For example,
15 antennas which are vertically polarized, horizontally polarized, or circularly polarized can have application with the embodiments of the present invention. Moreover, the antennas used with the embodiments illustrated in Figures 19A-C can include components
20 which extend or further pivot to increase the length of, or change the shape of, the antenna. Those skilled in the art will appreciate that the components necessary to carry out wireless communication, such as cellular telephone communication, can be packaged in the
25 communications card 250 or in a DAA adapted for such purpose. Further information regarding wireless computer networks can be obtained from IEEE 802.11 Standard (and any available drafts thereof) which are all now incorporated herein by reference.

30 Reference will next be made to Figure 20 which shows a communication card 250 and a replaceable DAA 332 which are adapted to interface with a portable cellular telephone via a cable 334 and a connector 336 which attaches directly to a corresponding connector (not
35 illustrated) on the portable cellular telephone (not illustrated). It will be appreciated that those skilled in the art will be able to provide replaceable DAAs 332

and connectors 336 which are adapted to function with any number of cellular telephones or other communications devices and which allow the user to easily and quickly change the application to which the communications card is put.

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Reference will next be made to Figure 21. Figure 21 provides a perspective view of a communications card generally designated 340. The communications card 340 follows the PCMCIA (also referred to as PC Card) Type III standard for dimensions and configuration. The height of a PCMCIA Type III card is still not great enough to allow a standard RJ-xx series receptacles to be mounted therein. In the communications card 340 illustrated in Figure 21, a T-shaped cutout 328 is removed from the housing of the communications card 340. The T-shaped cutout 328 accommodates the biased clip 12 and the ridge 18 present on the plug 10. The shape of the T-shaped cutout 328 engages the biased clip 12 and the ridge 18 to hold the plug 10 in place. Represented in Figure 21 are two receptacles, each generally designated at 326. Preferably, one of the receptacles 326 is an eight conductor RJ-45 receptacle, which is called for in some computer network standards, and the other of the receptacles 326 is an RJ-11 receptacle.

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In view of the foregoing, it will be appreciated that the present invention provides a communications line receptacle for use with a miniaturized communications device wherein the electrical contacts are shielded from the surrounding environment and which is resistant to breakage and which can be moved out of the way when not being used. The present invention also provides a communications line receptacle which is easily replaceable if broken. The present invention also provides a communications card which can be readily adapted to meet various communications standards and which can provide wireless communications.

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5 The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description.

What is claimed is:

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1. An apparatus for receiving an RJ series plug having a biased clip and for making electrical connection with at least first and second electrical contacts provided on the plug and conveying any signals on the first and second electrical contacts to a communications device, the apparatus comprising:

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body means, the body means having a thickness;
recess means provided in the body, the recess means having an open first end and a closed second end, the recess means having dimensions such that
10 the plug is closely received therein;

means for releasably engaging the biased clip such that the plug is releasably held in the recess means;

15 a first electrical conductor provided in the recess means, the first electrical conductor being positioned such that it makes electrical continuity with the first electrical contact in the plug when the plug is received by the recess means and when
20 the means for releasably engaging the biased clip engages the biased clip;

a second electrical conductor provided in the recess means, the second electrical conductor being positioned such that it makes electrical continuity
25 with the second electrical contact in the plug when the plug is received by the recess means and when the means for releasably engaging the biased clip engages the biased clip;

means for conveying any electrical signal present on the first and second electrical contacts to the communications device; and

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expandable means, located at the second end of the recess means, for isolating the first and second electrical contacts from electrical contact
35 with an object in a surrounding environment such that passage of current from one or more of the first and second electrical contacts to an object

5 present in the surrounding environment is prevented, the expandable means having a first position within the thickness of the body and a second expanded position which is outside the thickness of the body, the expandable means being movable to, and tending to return to, the first position when the plug is removed from the recess means.

10 2. An apparatus as defined in claim 1 wherein the means for isolating comprises an expandable and stretchable membrane anchored at the second end of the recess means.

15 3. An apparatus as defined in claim 1 wherein the body means comprises a first side and a second side and wherein the recess means comprises a rectangular recess having three walls, the walls being oriented substantially perpendicularly to the first side.

20 4. An apparatus as defined in claim 3 wherein the four walls comprise a first pair of parallel opposing walls each having a length about equal to .26 inches and the third wall has a length about equal to .46 inches.

25 5. An apparatus as defined in claim 3 wherein the four walls comprise a first pair of parallel opposing walls each having a length about equal to .26 inches and the third wall has a length about equal to .38 inches.

30 6. An apparatus as defined in claim 1 wherein the means for releasably engaging the biased clip comprises a ridge provided on a side of the recess means.

7. An apparatus for receiving a plug having a biased clip and for making electrical connection with at least first and second electrical contacts provided on the plug, the apparatus comprising:

5 a communications device, the communications device having a first side with a dimension which is not substantially greater than 8mm;

body means, the body means including at least one recess means provided in the body means, the recess means having dimensions such that the plug is closely received therein;

unit means for holding the body;

10 means for removably holding the unit means substantially within the communications device such that the unit means and the body means can be removed from and inserted into the communications device as a unitary module;

15 a first electrical conductor provided in the recess means, the first electrical conductor being positioned such that it makes electrical continuity with the first electrical contact in the plug when the plug is received by the recess means;

20 a second electrical conductor provided in the recess means, the second electrical conductor being positioned such that it makes electrical continuity with the second electrical contact in the plug when the plug is received by the recess means; and

25 means for conveying any electrical signal present on the first and second electrical contacts to the communications device.

30 8. An apparatus as defined in claim 7 wherein the unit means comprises a direct access arrangement.

35 9. An apparatus as defined in claim 8 wherein the direct access arrangement comprises a billing tone filter.

10. An apparatus as defined in claim 7 wherein the recess means comprises at least one RJ-xx series receptacle.

5 11. An apparatus as defined in claim 7 further comprising means for extending and retracting the body means into and out of the unit means.

10 12. An apparatus as defined in claim 11 wherein the means for extending and retracting the body means further comprises means for holding the body means in an extended position.

15 13. An apparatus as defined in claim 11 further comprising means for removing the body means from the unit means.

20 14. An apparatus as defined in claim 7 further comprising an expandable member located at the second end of the recess means, the expandable member isolating the first and second electrical contacts from electrical continuity with an object in the surrounding environment such that passage of current from one or more of the first and second electrical contacts to an object present in the surrounding environment is prevented.

30 15. An apparatus as defined in claim 7 wherein the means for isolating comprises an expandable and stretchable membrane anchored at the second end of the recess means.

35 16. An apparatus as defined in claim 7 wherein the body comprises a thickness and wherein the expandable means has a first position within the thickness of the body and a second expanded position which is outside the thickness of the body, the expandable means being biased to return to the first position.

17. An apparatus as defined in claim 7 wherein the body means comprises a first side and a second side and wherein the recess comprises a rectangular recess having three walls, the walls being oriented substantially perpendicularly to the first side.

18. An apparatus as defined in claim 17 wherein the four walls comprise a first pair of parallel opposing walls each having a length in the range from about .265 inches to about .285 inches and the third wall has a length in the range from about .45 inches to about .475 inches.

19. An apparatus as defined in claim 17 wherein the four walls comprise a first pair of parallel opposing walls each having a length in the range from about .265 inches to about .285 inches and the third wall has a length in the range from about .375 inches to about .4 inches.

20. An apparatus as defined in claim 7 further comprising means for releasably engaging the biased clip on the plug.

21. An apparatus as defined in claim 7 wherein the unit means comprises a shell having a plurality of grooves and wherein the body means further comprises guides sliding within the grooves.

22. A communications device, the communications device having a first side with a dimension which is not substantially greater than 8mm, the communications device comprising;

data access means for interfacing communications signals received and generated by the communications device;

means for removably holding the data access means substantially within the communications

device such that the data access means can be removed from and inserted into the communications device as a unitary module; and

5 means for conveying a communications signal between the data access means and a signal utilizing device.

10 23. A communications device as defined in claim 22 wherein the means for conveying a communications signal comprises:

body means, the body means including at least one recess means provided in the body means, the recess means having dimensions such that a plug is closely received therein;

15 a first electrical conductor provided in the recess means, the first electrical conductor being positioned such that it makes electrical continuity with the first electrical contact in the plug when the plug is received by the recess means;

20 a second electrical conductor provided in the recess means, the second electrical conductor being positioned such that it makes electrical continuity with the second electrical contact in the plug when the plug is received by the recess means; and

25 means for conveying any electrical signal present on the first and second electrical contacts to the communications device.

30 24. A communications device as defined in claim 22 wherein the means for conveying a communications signal comprises an antenna.

35 25. A communications device as defined in claim 22 wherein the means for conveying a communications signal comprises:

a cord; and

means for connecting the cord to a portable telephone.

5 26. A communications card for use in a data utilization device and for receiving an RJ-xx series plug having a biased clip and for making electrical connection with at least first and second electrical contacts provided on the plug, communications card having a first side with a dimension which is not
10 substantially greater than 8mm and comprising:

a first surface;

a second surface, the second surface being substantially parallel to the first surface and forming upper and lower surfaces of the
15 communications card;

a first end;

recess means provided at the first end, the recess means being oriented substantially perpendicularly to the upper surface and the lower
20 surface, the recess means having dimensions such that the plug is closely received therein;

a first electrical conductor provided in the recess means, the first electrical conductor being positioned such that it makes electrical continuity
25 with a first electrical contact in the plug when the plug is received by the recess means;

a second electrical conductor provided in the recess means, the second electrical conductor being positioned such that it makes electrical continuity
30 with a second electrical contact in the plug when the plug is received by the recess means;

means for conveying any electrical signal present on the first and second electrical contacts to the communications device; and

35 a cutout formed on the first surface adjacent to the recess means, the cutout shaped to receive the biased clip.

27. An apparatus for receiving an RJ series plug having a biased clip and for making electrical connection with at least first and second electrical contacts provided on the plug, the apparatus comprising:

5 a communications device, the communications device having a first side with a dimension which is not substantially greater than 8mm;

a body, the body having a first half and a second half;

10 a recess in the body, the recess having an open first end and a closed second end, the recess having dimensions such that the plug is closely received therein;

15 means for pivotally rotating the body into and out of the first side of the communications device such that both the first half and the second half of the body are substantially entirely within the communications device when in a first position and at least the first half of the body being entirely within the communications device when the body is in a second position, the recess in the body being accessible when the body is in the second position;

20 means for pulling the body from the communications device by a human finger when the body is in the first position and rotated into the communications device, the means for pulling protruding beyond the first side of the communications device when the body is in the first position;

25 means for releasably engaging the biased clip such that the plug is releasably held in the recess;

30 a first electrical conductor provided in the recess, the first electrical conductor being positioned such that it makes electrical continuity with the first electrical contact in the plug when the plug is received by the recess and when the

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means for releasably engaging the biased clip engages the biased clip;

5 a second electrical conductor provided in the recess, the second electrical conductor being positioned such that it makes electrical continuity with the first electrical contact in the plug when the plug is received by the recess and when the means for releasably engaging the biased clip engages the biased clip; and

10 means for conveying any electrical signal present on the first and second electrical contacts to the communications device.

15 28. An apparatus as defined in claim 27 further comprising an expandable member located at the second end of the recess, the expandable member isolating the first and second electrical contacts from electrical continuity with an object in the surrounding environment such that passage of current from one or more of the
20 first and second electrical contacts to an object present in the surrounding environment is prevented.

25 29. An apparatus as defined in claim 28 wherein the means for isolating comprises an expandable and stretchable membrane anchored at the second end of the recess.

30 30. An apparatus as defined in claim 27 wherein the body comprises a first side and a second side and wherein the recess comprises a rectangular recess having three walls, the walls being oriented substantially perpendicularly to the first side.

35 31. An apparatus for holding an RJ series plug having a biased clip, first and second electrical contacts located on a first face having a width and a length, the apparatus further for making electrical

connection with at least first and second electrical contacts provided on the plug, the apparatus comprising:

a body;

5 a recess in the body, the recess having a first opening, an adjacent second opening, a first wall, a second wall adjacent and perpendicular to the first wall, and a third wall adjacent and perpendicular to the second wall, the second wall having a dimension slightly larger than the width
10 of the first wall such that the plug is closely received therein;

15 a member pivotally attached to the body such that the member pivots from a first position substantially over the recess to a second position substantially no more than forty-five degrees from the first position;

20 means for biasing the member toward the recess such that the member can be moved to the second position and the first face of the plug placed in the recess facing away from the member and the member engages the biased clip and is biased to hold the first face of the plug in the recess;

25 a first electrical conductor provided in the recess, the first electrical conductor being positioned such that it makes electrical continuity with the first electrical contact in the plug when the plug is received by the recess and when the means for releasably engaging the biased clip engages the biased clip;

30 a second electrical conductor provided in the recess, the second electrical conductor being positioned such that it makes electrical continuity with the second electrical contact in the plug when the plug is received by the recess and when the means for releasably engaging the biased clip
35 engages the biased clip; and

means for conveying any electrical signal present on the first and second electrical contacts to the communications device.

5 32. An apparatus for receiving an RJ series plug having a biased clip and for making electrical connection with at least first and second electrical contacts provided on the plug, the apparatus comprising:

10 a communications device, the communications device having a first side with a dimension which is not substantially greater than 8mm;

body means;

shell means for holding the body;

15 means for removably holding the shell means substantially within the communications device such that the shell means and the body can be removed from and inserted into the communications device as a unitary module;

means for sliding the body means into and out of the shell means;

20 means for pulling the body from the shell means by a human digit when the body is slid into the shell means, the means for pulling protruding beyond the first side of the communications device when the body is fully slid into the communications device;

25 recess means provided in the body means, the recess means having an open first end and a closed second end, the recess means having dimensions such that the plug is closely received therein;

30 means for releasably engaging the biased clip such that the plug is releasably held in the recess means;

35 a first electrical conductor provided in the recess means, the first electrical conductor being positioned such that it makes electrical continuity with the first electrical contact in the plug when the plug is received by the recess means and when

the means for releasably engaging the biased clip engages the biased clip;

5 a second electrical conductor provided in the recess means, the second electrical conductor being positioned such that it makes electrical continuity with the first electrical contact in the plug when the plug is received by the recess means and when the means for releasably engaging the biased clip engages the biased clip; and

10 means for conveying any electrical signal present on the first and second electrical contacts to the communications device.

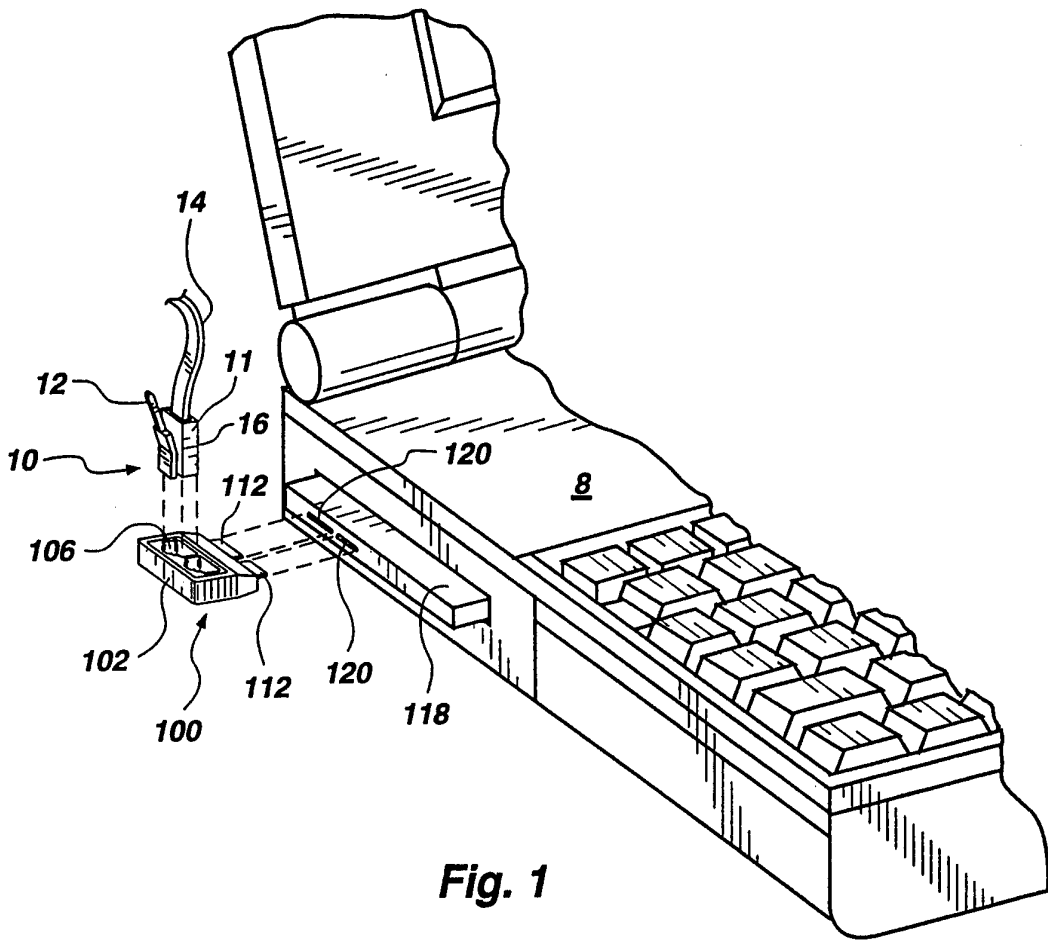


Fig. 1

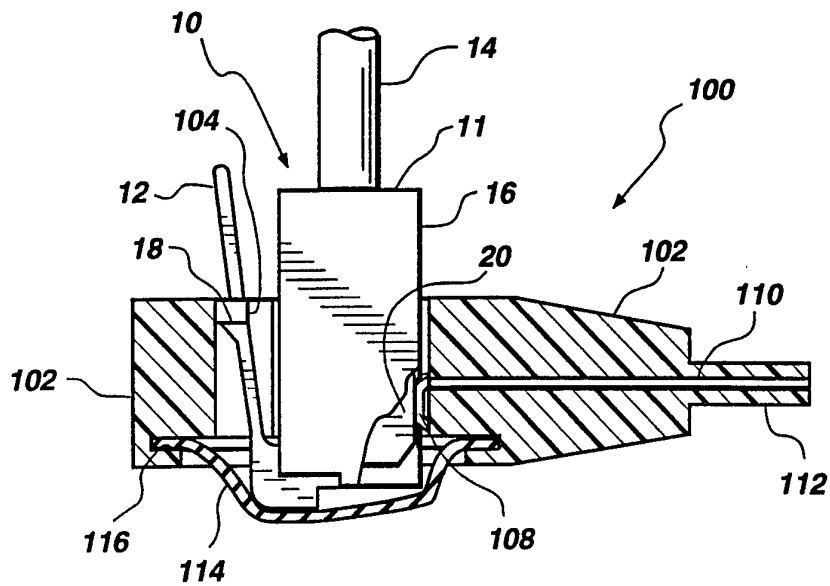


Fig. 2

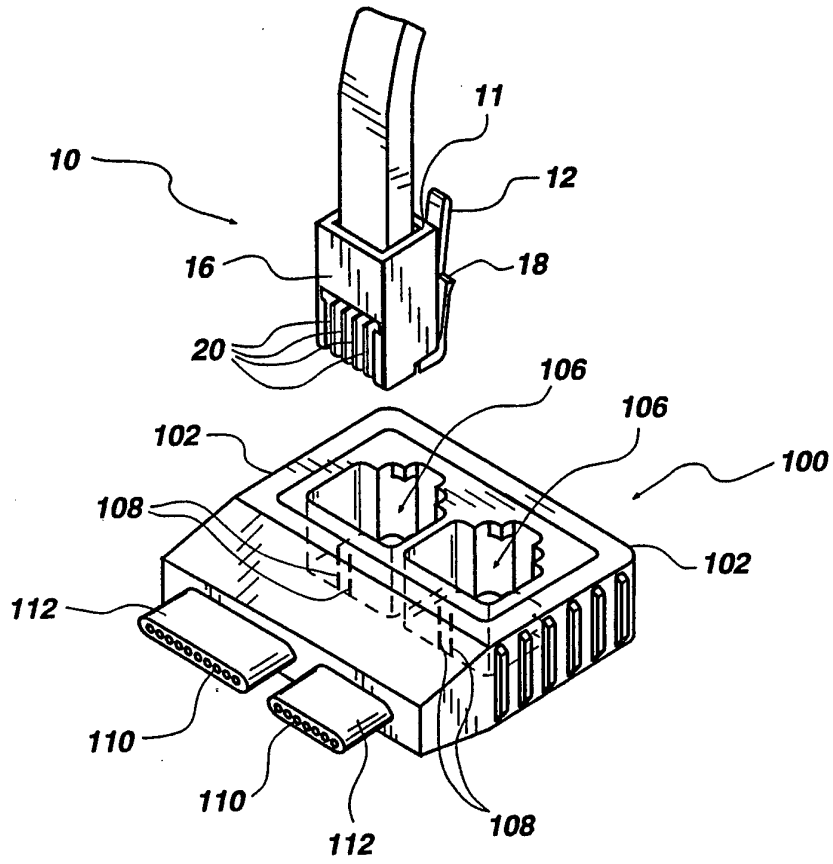


Fig. 3

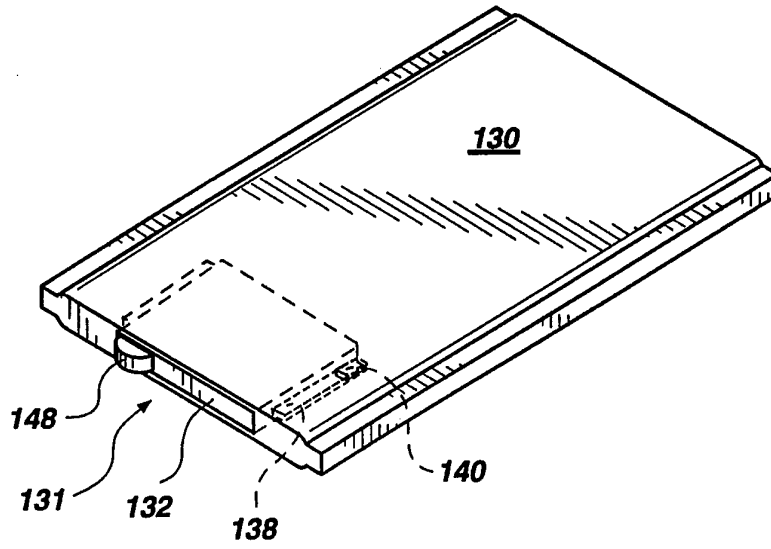


Fig. 4

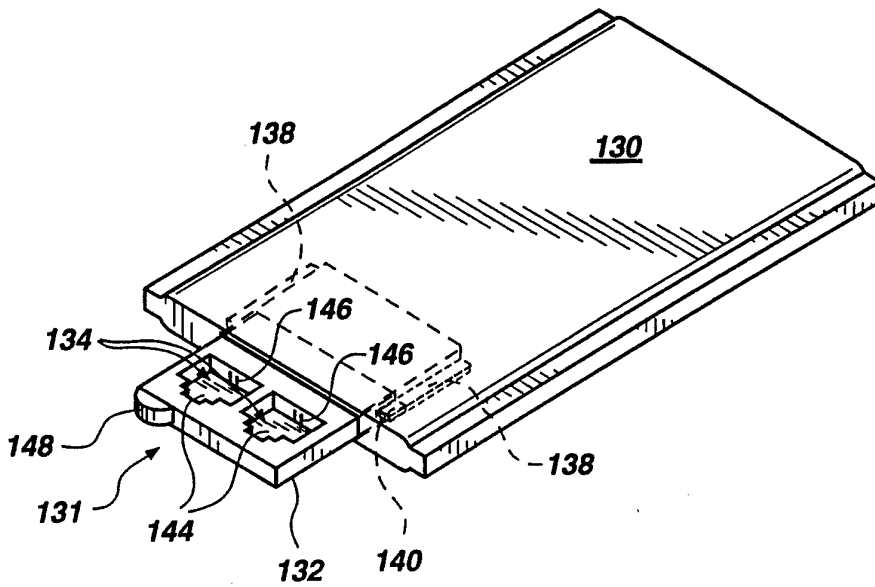


Fig. 5

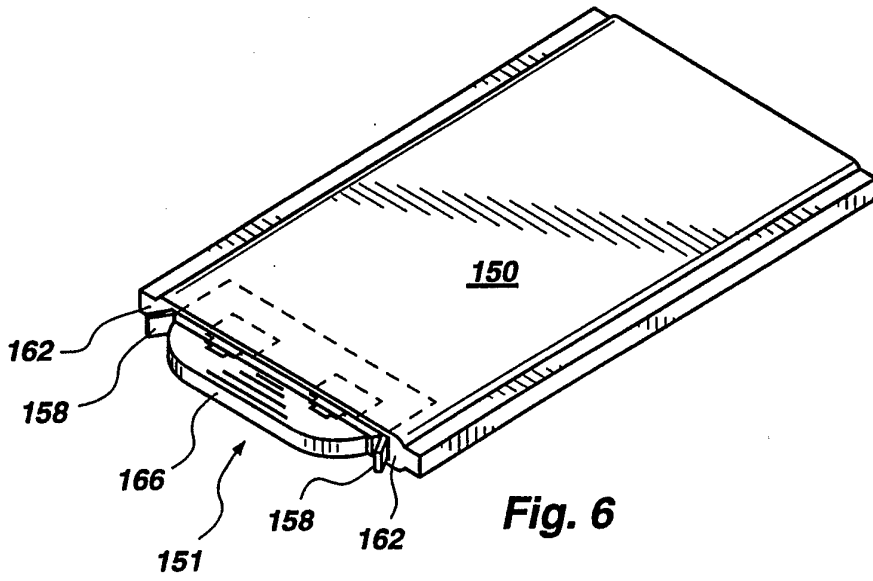


Fig. 6

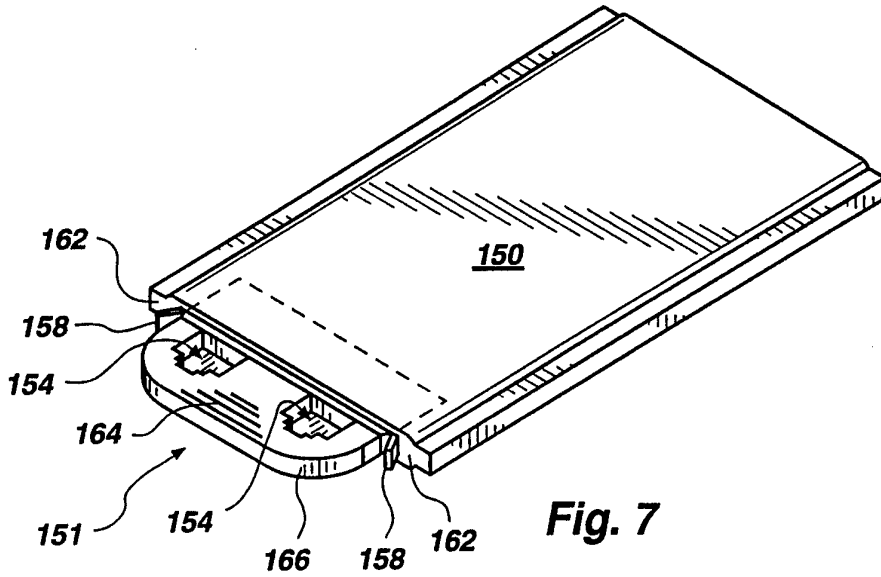


Fig. 7

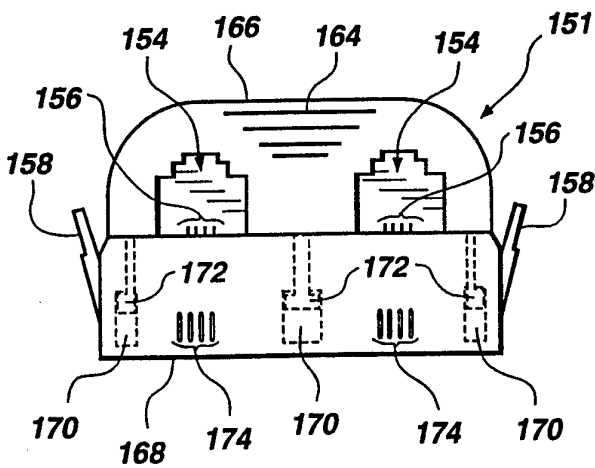


Fig. 8

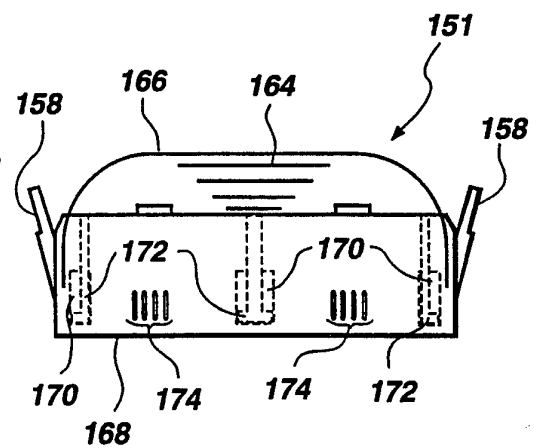


Fig. 9

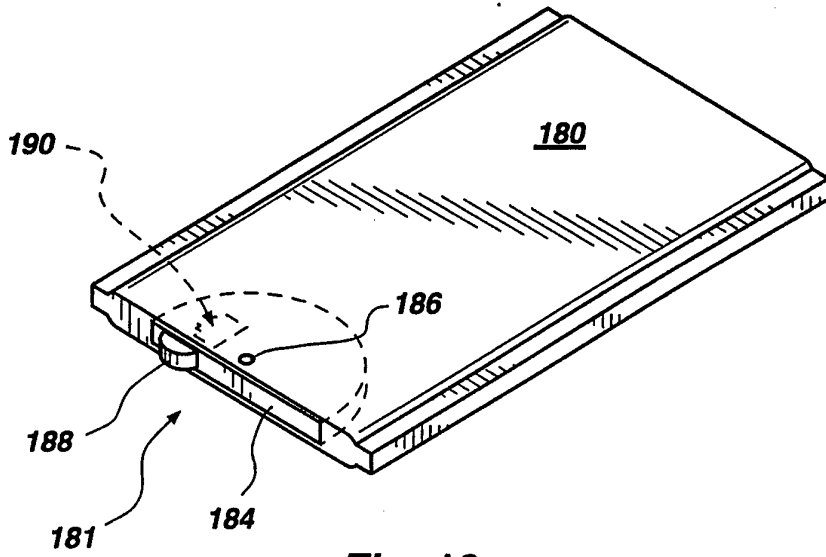


Fig. 10

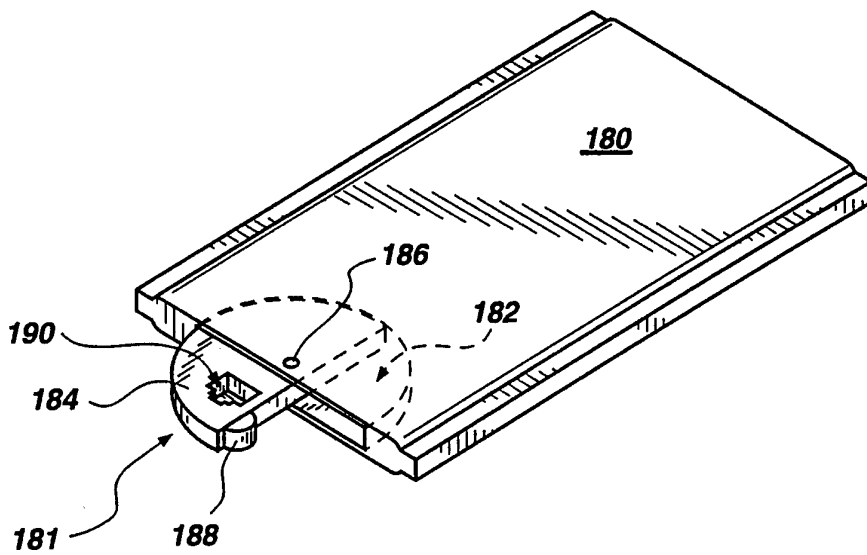


Fig. 11

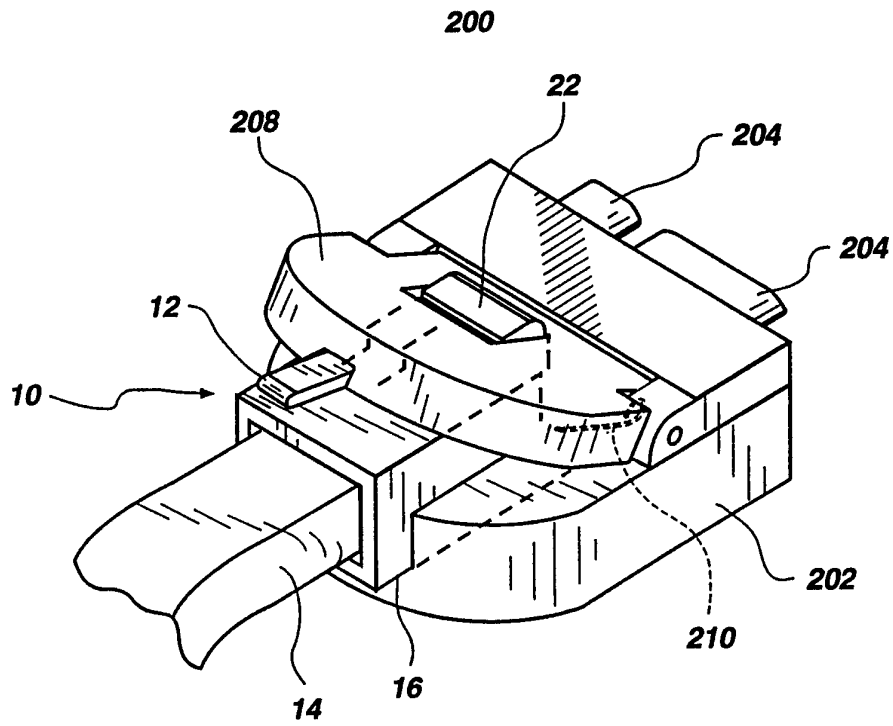


Fig. 12

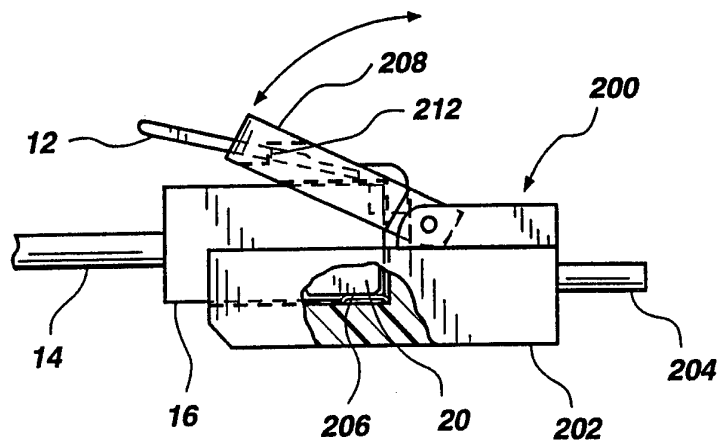


Fig. 13

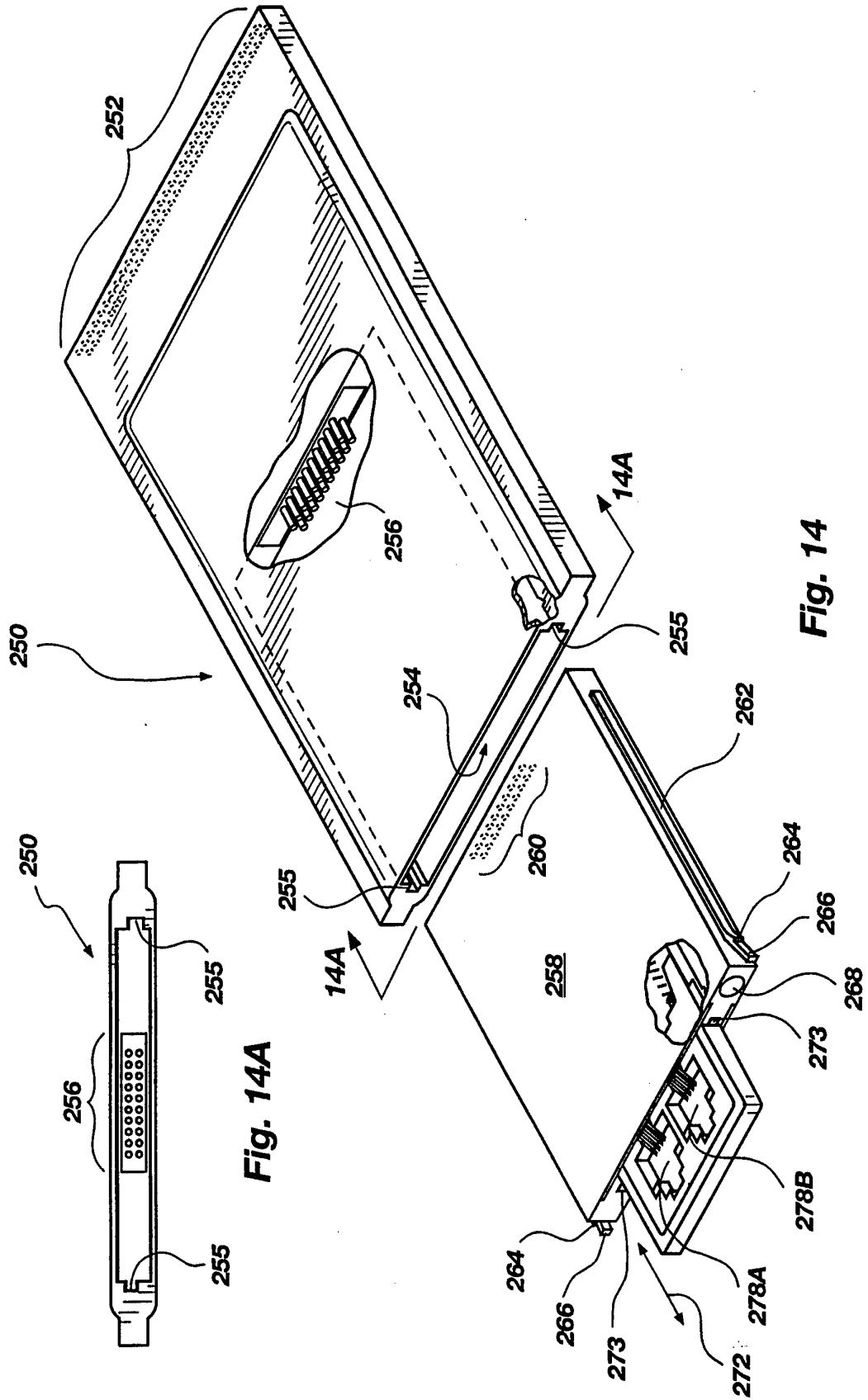


Fig. 14A

Fig. 14

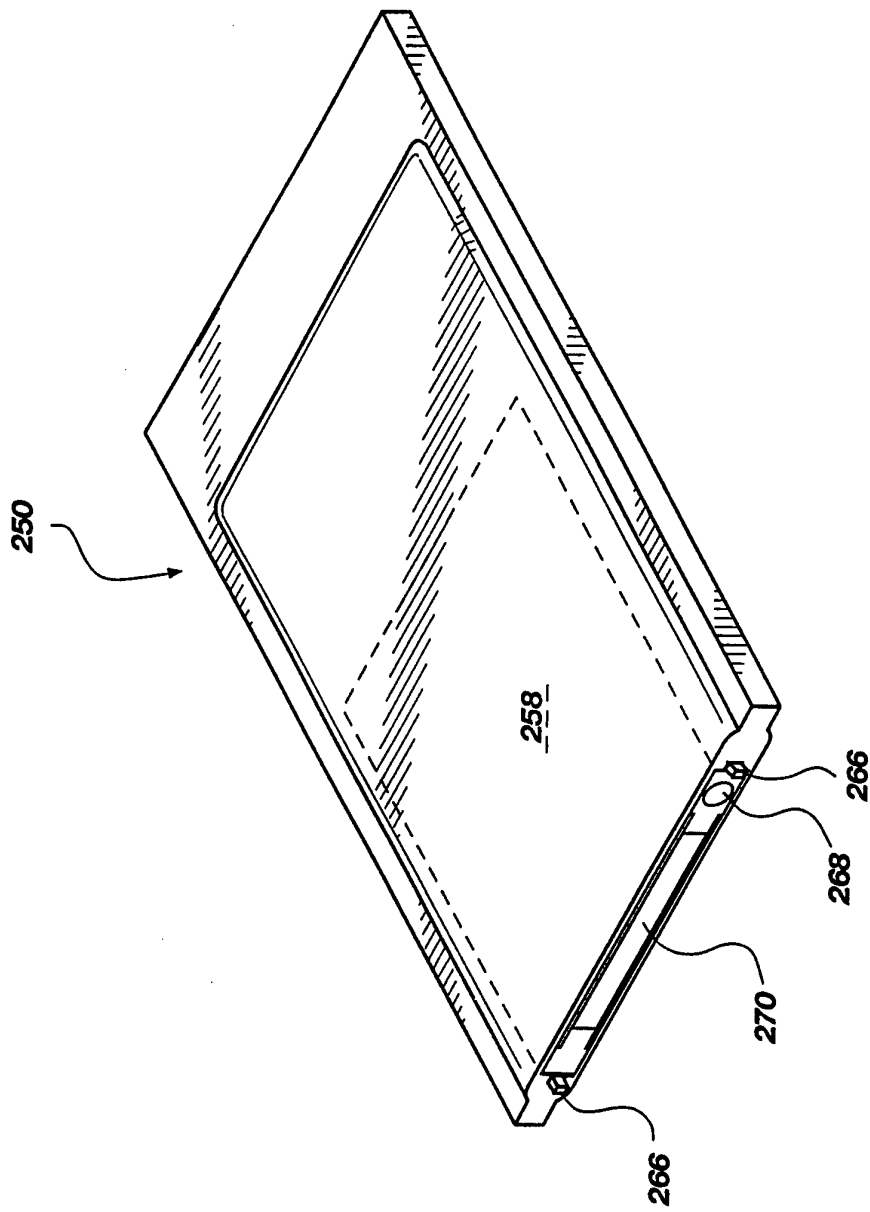


Fig. 14B

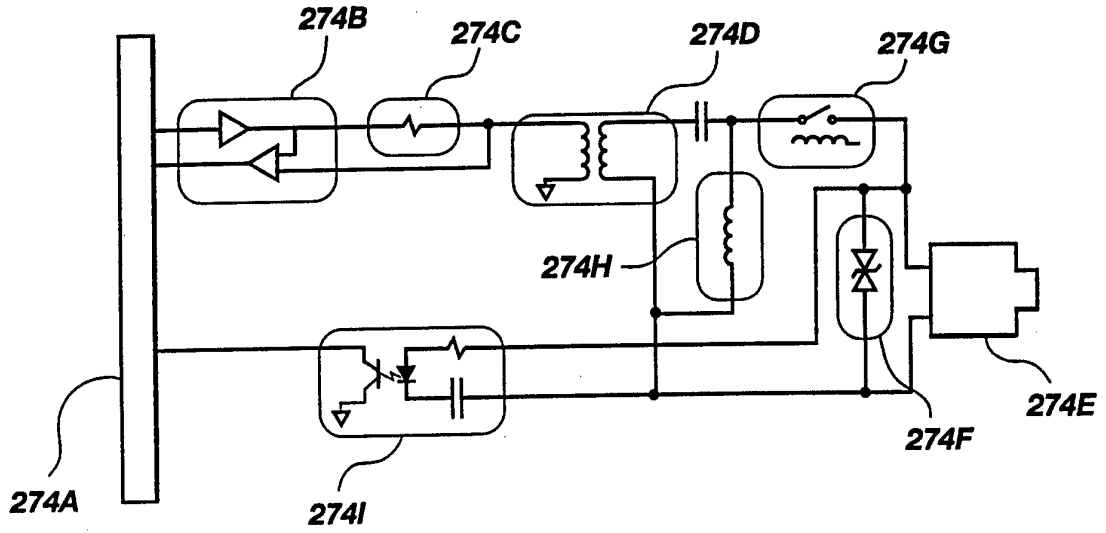


Fig. 14C

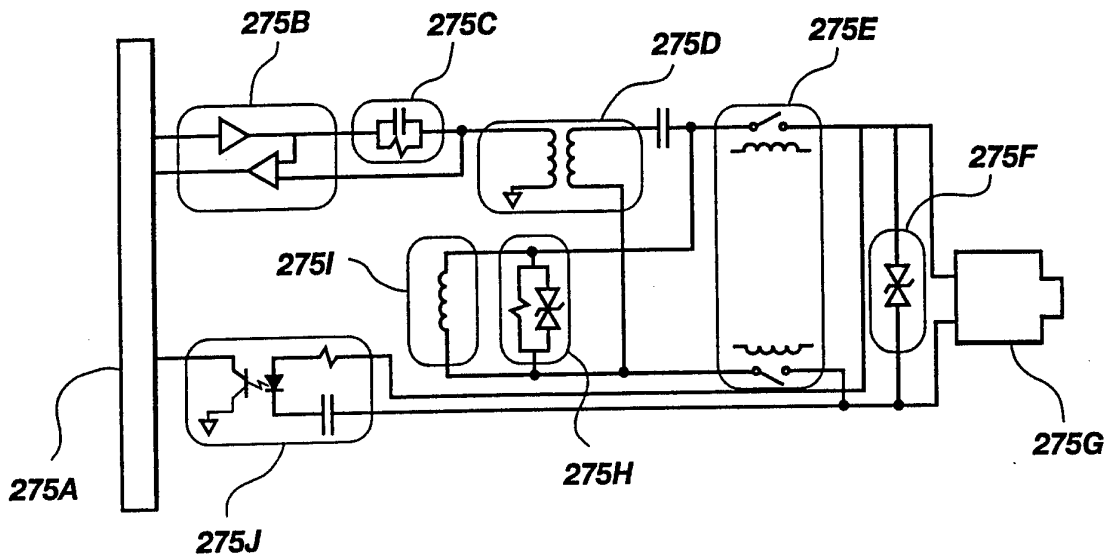


Fig. 14D

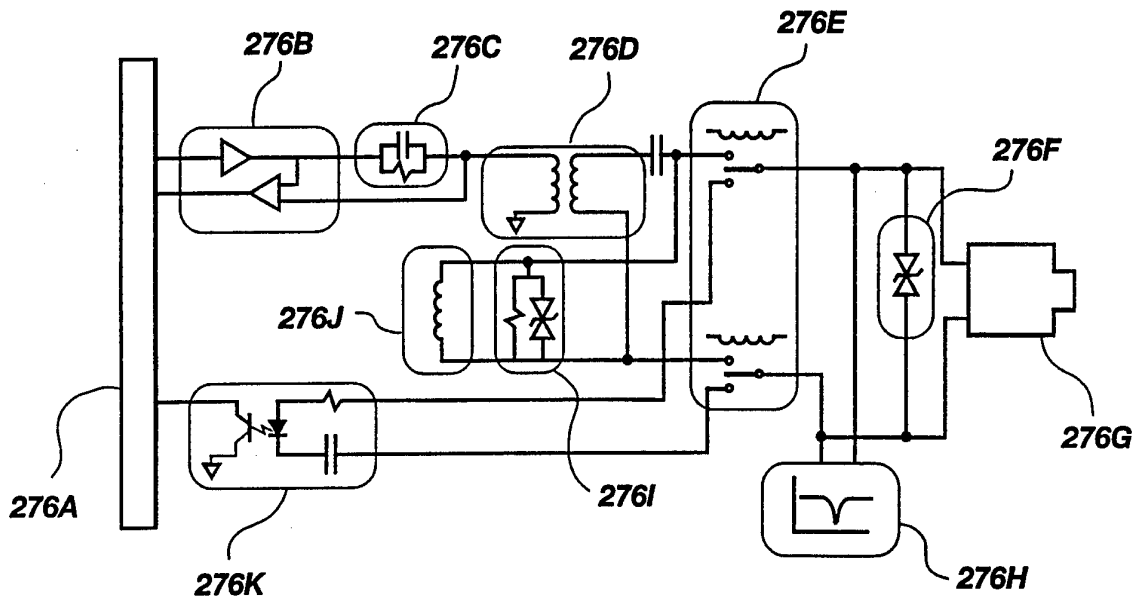


Fig. 14E

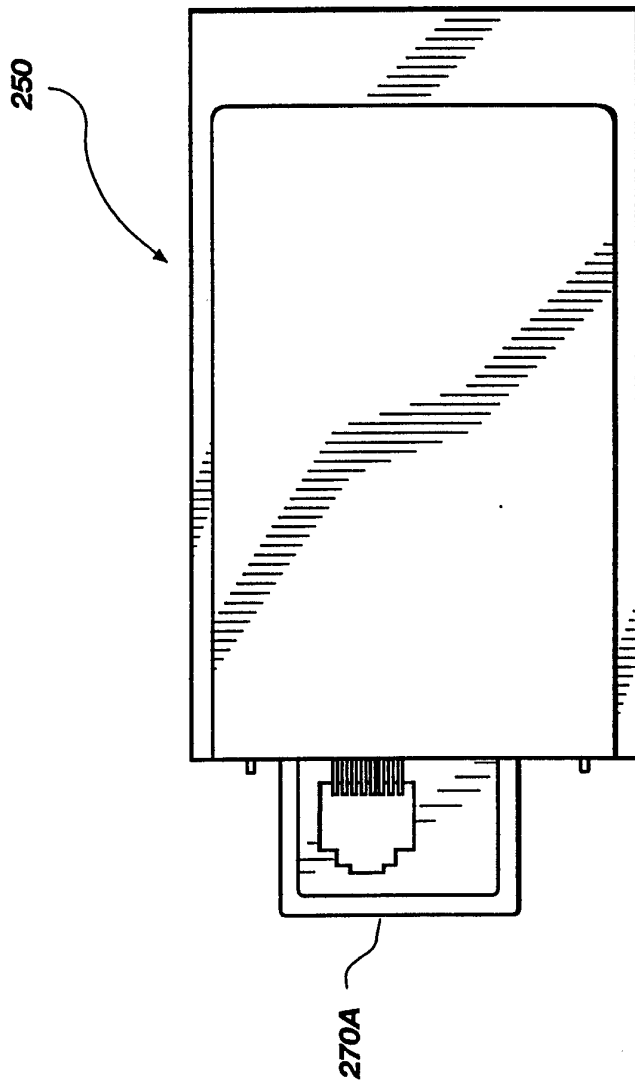


Fig. 14F

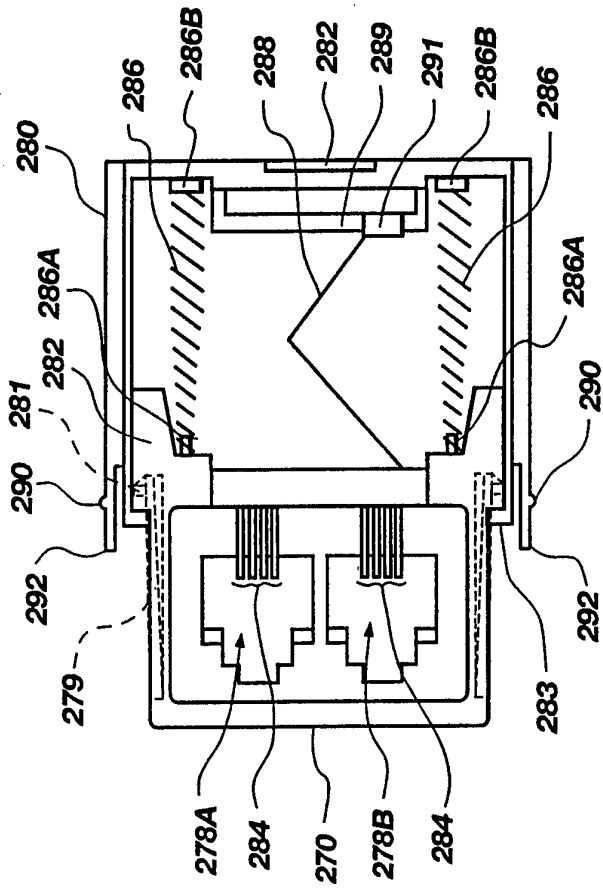


Fig. 15A

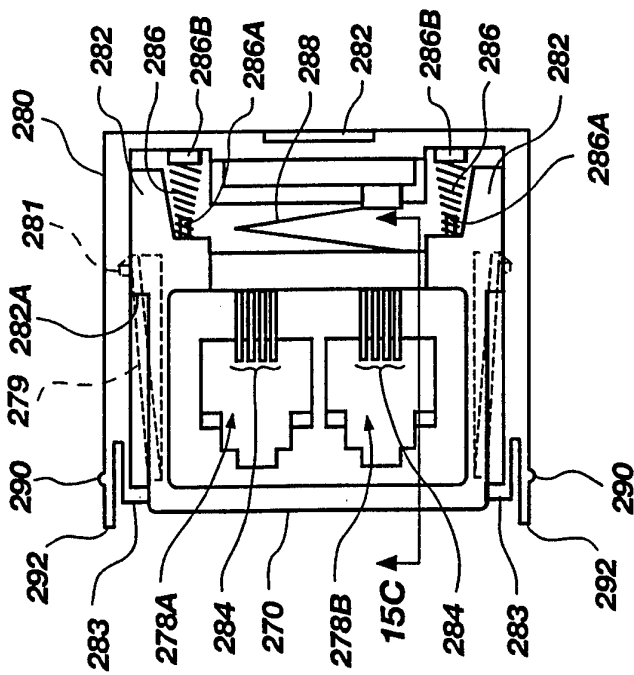


Fig. 15B

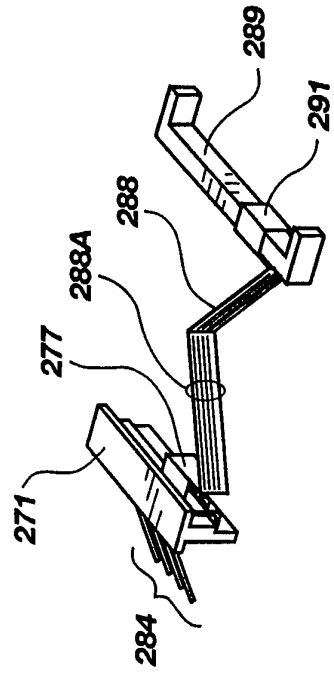


Fig. 15C

Fig. 15D

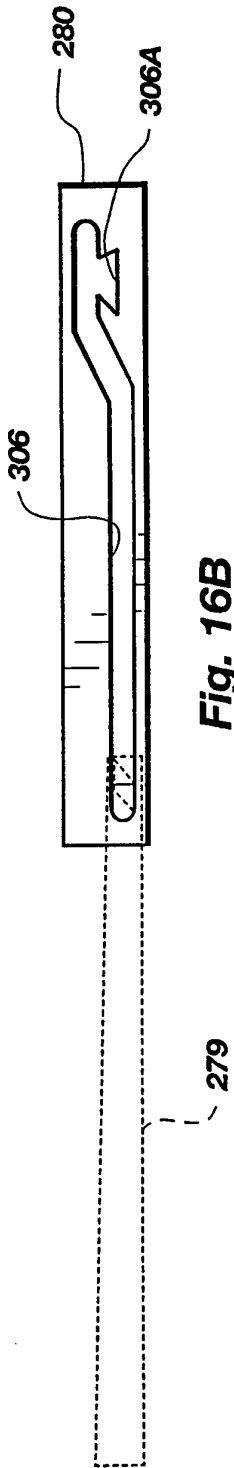


Fig. 16B

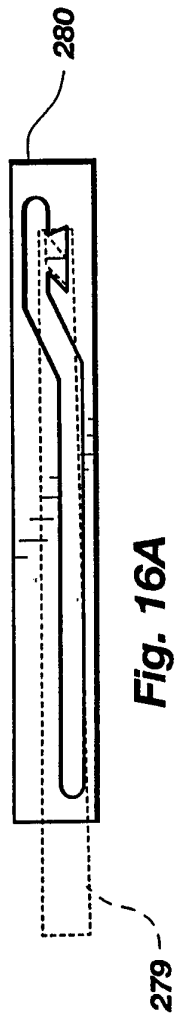


Fig. 16A

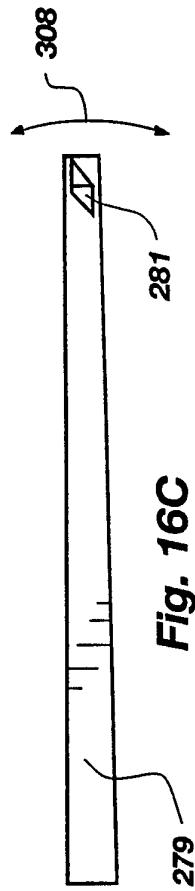


Fig. 16C

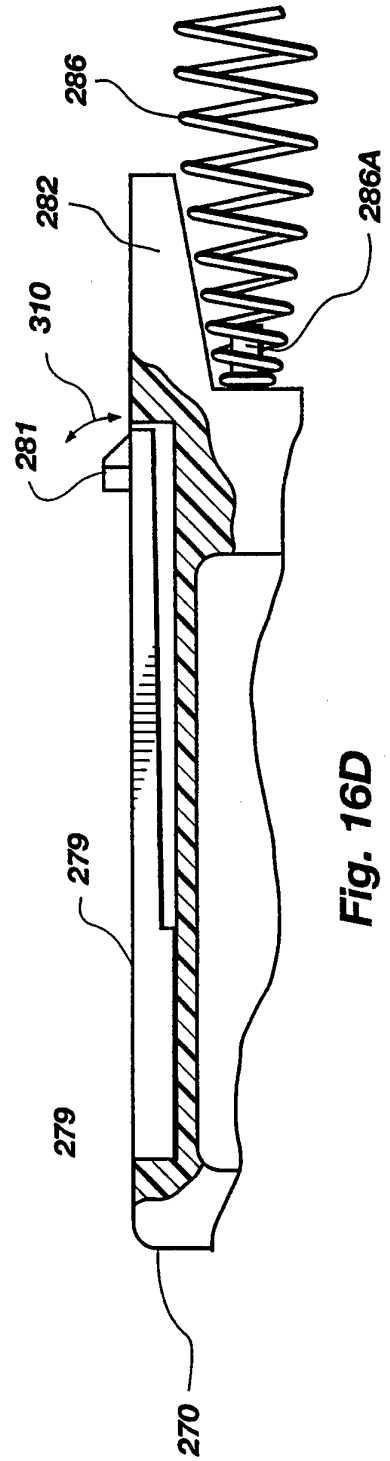


Fig. 16D

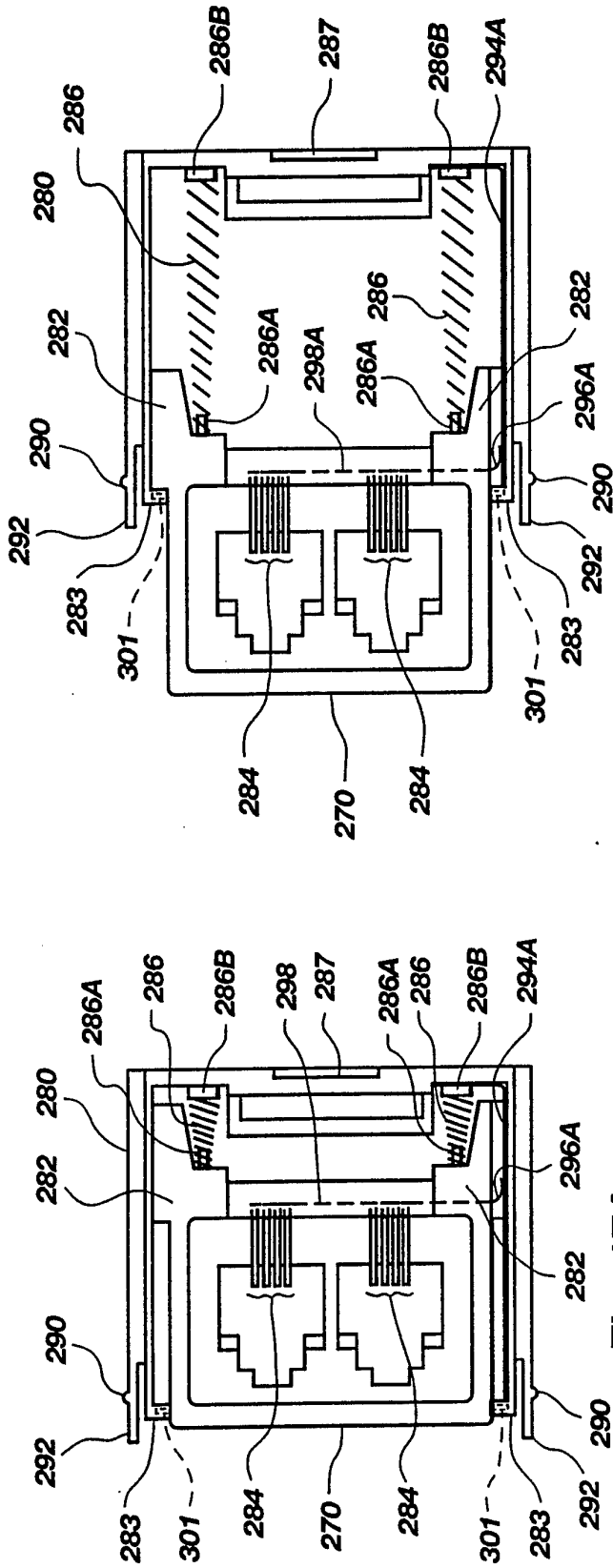


Fig. 17B

Fig. 17A

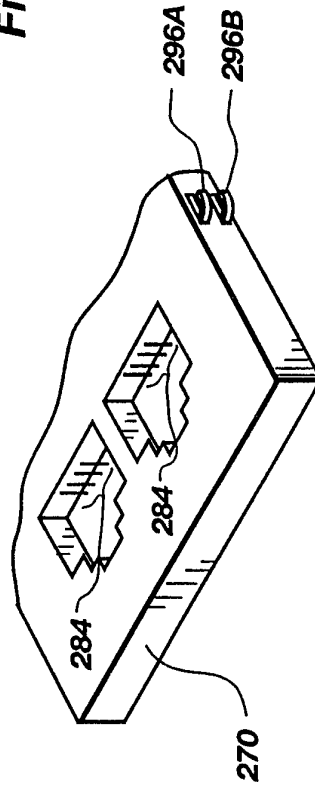


Fig. 17C

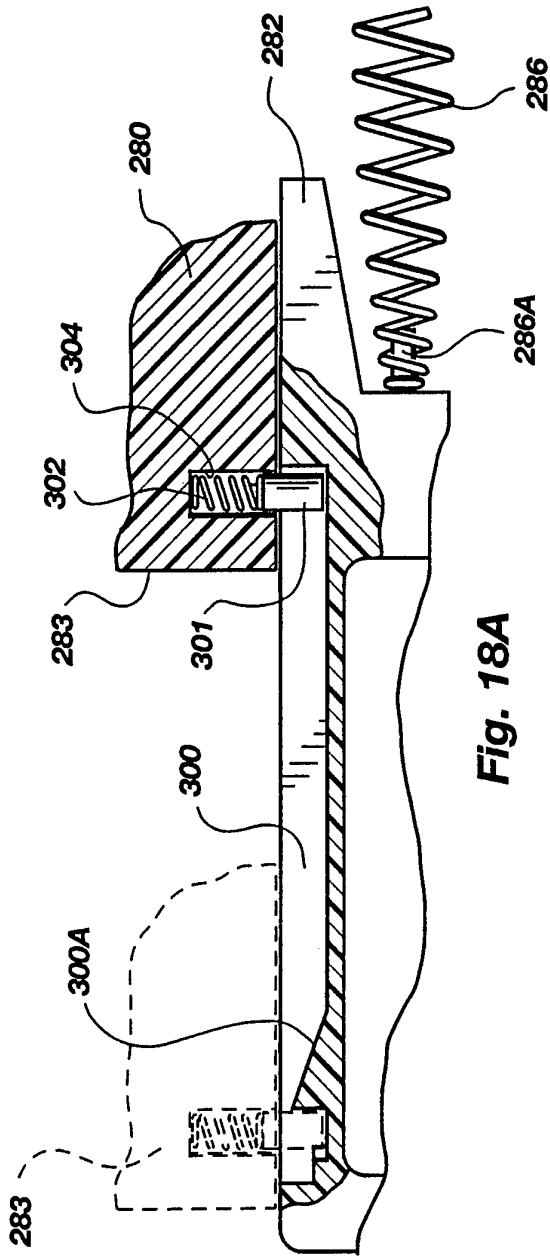


Fig. 18A

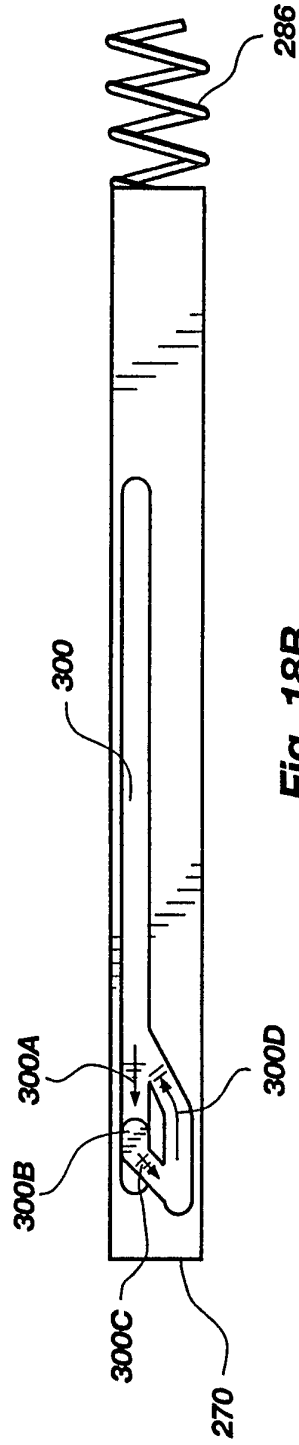


Fig. 18B

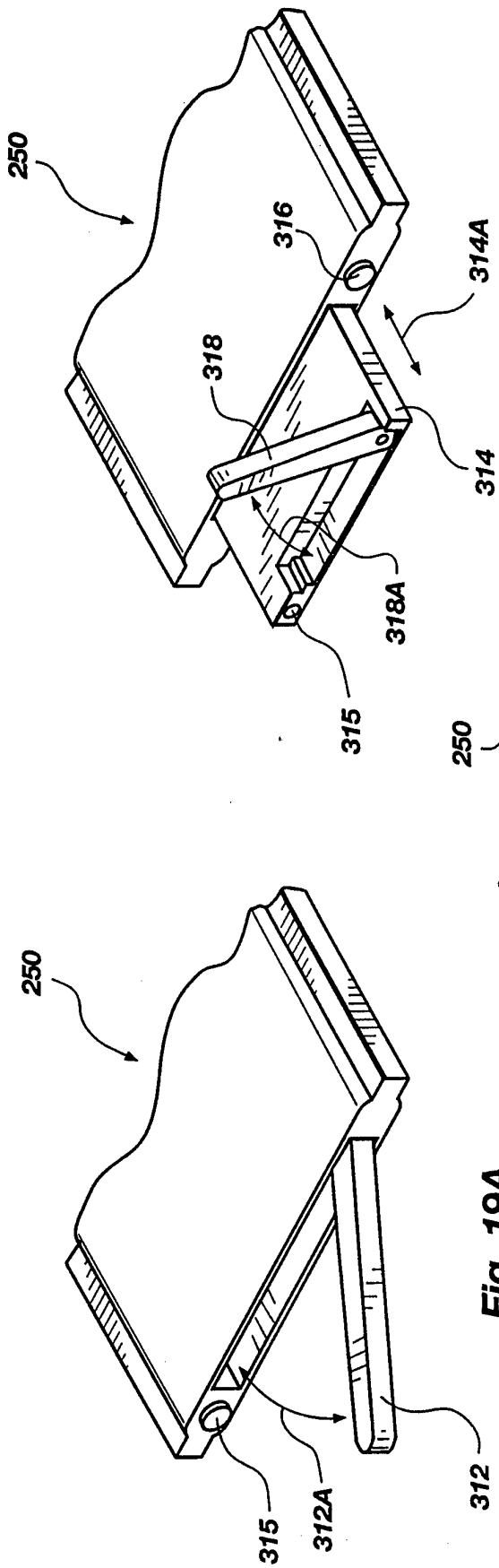


Fig. 19B

Fig. 19A

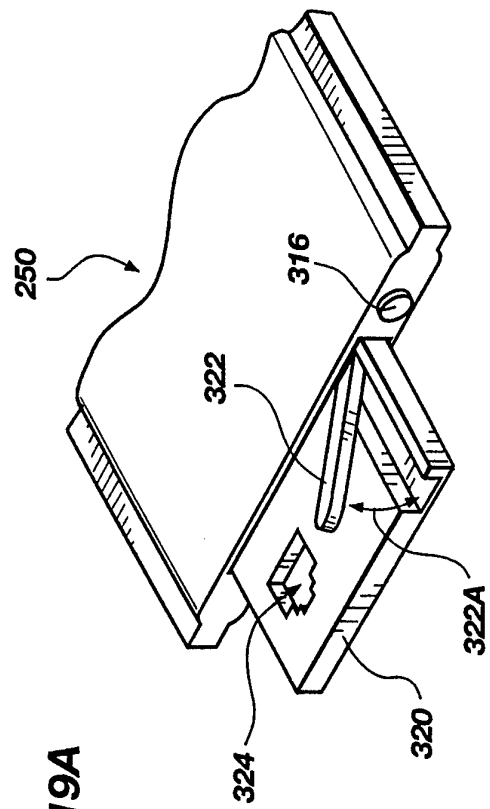


Fig. 19C

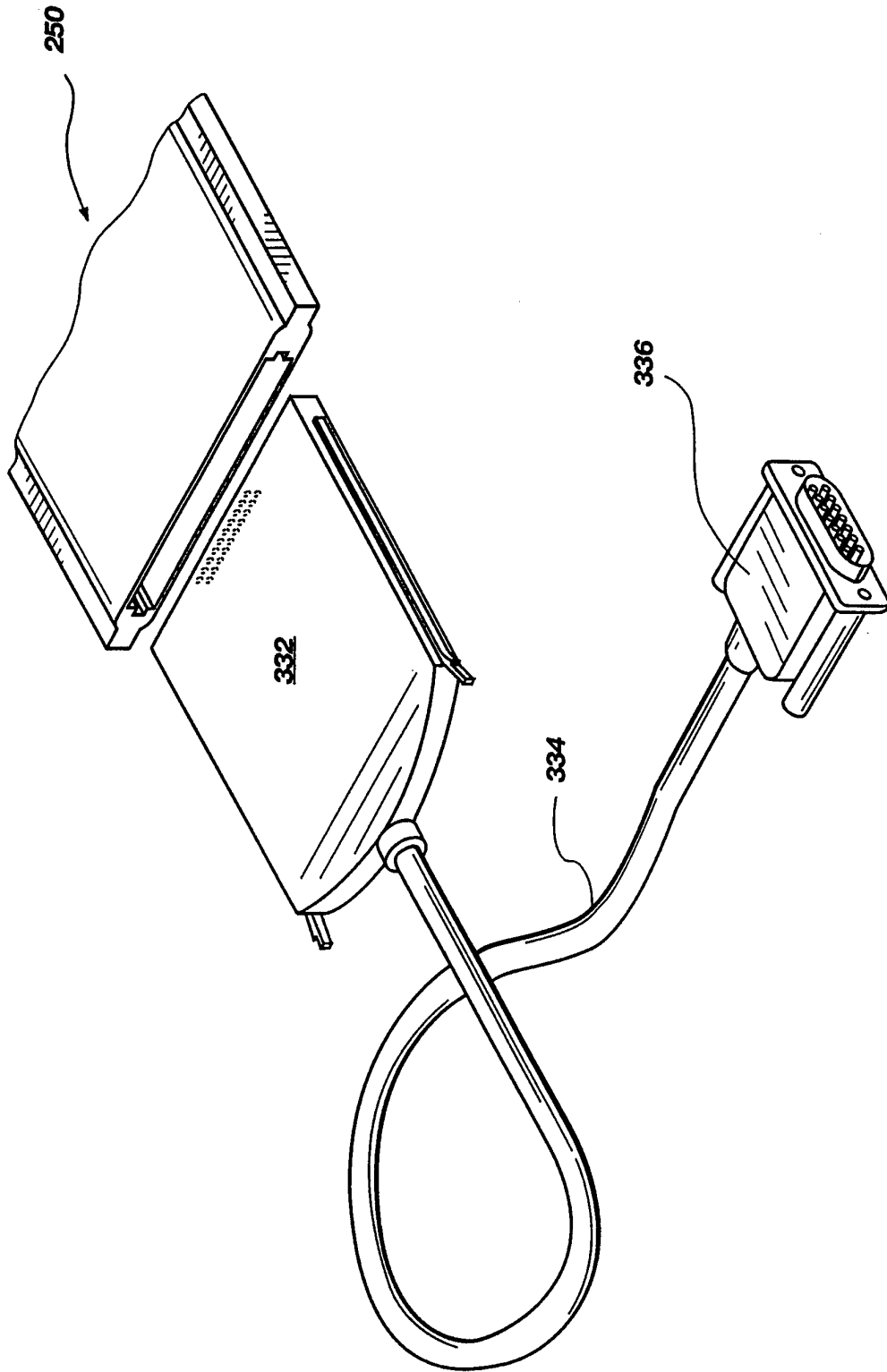


Fig. 20

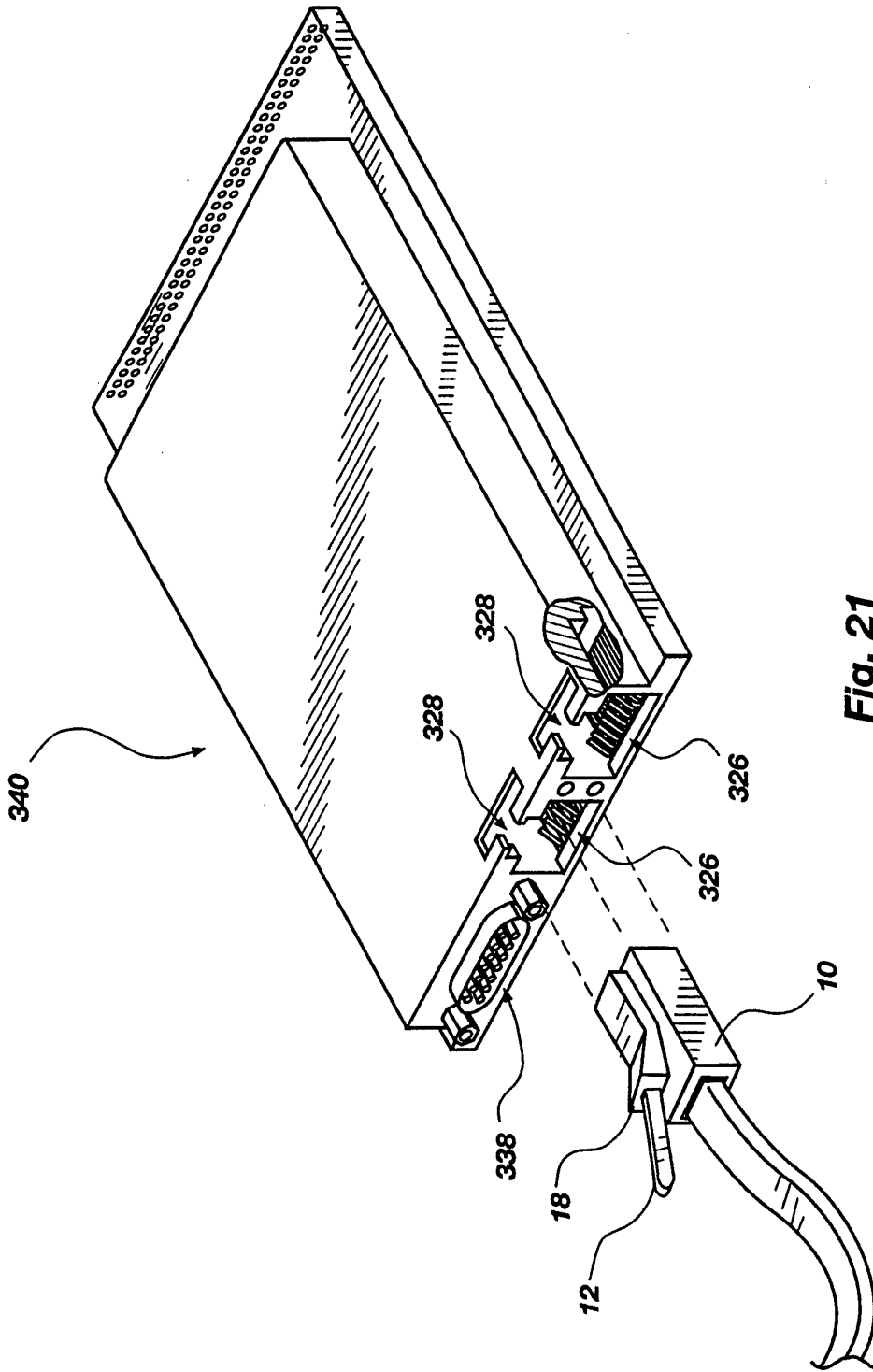


Fig. 21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/13106

A. CLASSIFICATION OF SUBJECT MATTER IPC(6) :H01R 13/50 US CL : 439/131, 676, 586 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 439/131, 676, 586, 135, 136, 638, 144 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,648,682 (TUBBS)10 MARCH 1987, SEE ENTIRE DOCUMENT	1-32
A,P	US, A, 5,285,014 (GILCHRIST) 08 FEBRUARY 1994, SEE ENTIRE DOCUMENT	1-32
A	US, A, 5,260,994 (SUFFI) 09 NOVEMBER 1993, SEE ENTIRE DOCUMENT	1-32
A	US, A, 4,968,260 (INGALSBE) 06 NOVEMBER 1990, SEE ENTIRE DOCUMENT	1-32
A	US, A, 4,878,848 (INGALSBE) 07 NOVEMBER 1989, SEE ENTIRE DOCUMENT	1-32
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 30 JANUARY 1995	Date of mailing of the international search report 13 FEB 1995	
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer DAN WITTELS <i>Joni Hill</i> Telephone No. (703) 308-1148	